THE RELATIONSHIP BETWEEN CHILDREN'S COMPUTER GAME USAGE AND CREATIVITY IN KOREA

A Dissertation

by

KYUNG-SOOK LEE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2005

Major Subject: Educational Psychology

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Approved by:

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ABSTRACT

The Relationship between Children's Computer Game Usage and Creativity in Korea.

(December 2005)

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This study investigated the relationships among children's creativity, computer games, natural play, TV, and their structured activities daily after school by the analysis of their time spent on computer games, and the other components with the *Torrance Test of Creative Thinking* (TTCT), using the statistical methods of MANOVA and SEM. Activity 5 of Verbal Form B and Activity 2 of Figural Forms B of the TTCT were used to measure students' verbal and figural creativity scores. Two hundreds and thirty eight 3rd and 6th grade students from one rural and one urban school in the Republic of Korea were studied. The study also examined whether any variables (i.e., gender, grade, location, achievement, genres of computer games and parental Social Economic Status) affected children's creativity scores and computer game usage.

Children using computer games heavily showed significantly higher scores on the scale of Figural Originality than those with moderate usage. Highly structured activity students had significantly higher scores on all Figural TTCT scales than did the moderately structured activity group. There was a significant location difference on Figural Originality and Figural Elaboration, parental SES, and time spent on TV. Time spent on free play did not show any differences on any TTCT scales. Time spent on TV

was differently correlated with the Figural TTCT by parental SES. Third graders obtained significantly higher scores than 6th graders on all the Verbal TTCT and Figural Elaboration scales. In this study, the subjects showed a significant preference for Role Playing Game (RPG) and Casual games. Gender differences on preferences of game genres, time spent on computer games and starting period of computer use were found. The MANOVA among genres of computer games on the TTCT scores was significant. The path models showed that the parent factor had strong correlation with children's figural creativity and the play factor was correlated more with verbal creativity.

DEDICATON

To His Kingdom and His Glory

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CHAPTER I

INTRODUCTION

Currently, most children play computer games for fun and some spend more time with computers than playing outdoor activities with friends. Scarlett, Naudeau, Salonius-Pastenak, and Ponte (2005) have described the trend of children's play as follows:

> Compared with previous generations, many children do not spend much time playing out-of doors, at least not in industrialized societies. This too suggests that today's children had less time to play out-of doors and were getting shortchanged with respect to opportunities to play. (p. 168)

Rather than playing outside with other children, they tend to stay at home to play computer or videogames by themselves or with friends (Gelfond & Salonius-Pasternak, 2005). The pattern of children's play seems be changing now.

There are two different attitudes toward using computer and internet games. One is supportive and positive to use not only the computer and internet but also computer games, because they are regarded as providing many benefits to children and teenagers to motivate their learning in diverse ways and for diverse students. Computer games stimulate interest, enjoyment, satisfaction, motivation, and challenge, which can be psychological components that may encourage creativity (Clements, 1991). Also, it is impossible for 21st century children to live without using or being familiar with computer technology, which promotes the point of view that playing such games

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This dissertation follows the style of the *Journal of Creative Behavior*.

encourages early use of the computer (Clements & Sarama, 2003; Marcinkiewicz & Sylwester, 2003).

Computer games often contain creative problem solving processes and allow children to use computer technology more comfortably (Roe & Muijs, 1998). Even when children don't know much about word processing, emailing, power point or web editing, the experiences of computer games reduce nervousness when they turn on a computer. Computer games provide for the different cognition processes (Goldstein, 2003). If the process of traditional thinking is described as sequential, that of computer games may be described as a simultaneous one. Greenfield noted the active interaction and 'parallel processing' environment which computer games provide for children (as cited in Roe & Muijs, 1998). The environment which computer games require is asking to read diverse information at one time and solve a problem based on analyzing simultaneous information in a short time. Some parents want their children to be exposed to computers earlier competitively so they let their children play computer games and expect them to be familiar with the computer environment as early as possible. Seiter (2004) said that working parents tend to support the early use of the computer, because they saw "their children's computer use as the promise of white-collar employment" (p. 93).

The other side of the debate offers a very strong negative stand toward the computer itself as well as computer games. These proponents argue that computer usage prevents children from learning through their own direct experience. Thus, children can't develop appropriately in emotional, cognitive, social and physical areas. Rather, they can be easily exposed to aggressiveness, violence, and lack of creativity (Alliance for Childhood, 2000). The effect of violent computer games may be much stronger in young

children rather than teenagers (Griffiths, 2000). Computer games are not full of children's creativity but rather of adult game developers' (Scarlett et al., 2005). Children's pursuit of play with computers was not consistent with parental plans for computer usage as children's bright white collar vocational future (Seiter, 2004). Children regard a computer as a play tool rather than a learning one. Negative correlation with children's achievement and addiction to computer games are the elements to be emphasized (Roe & Muijs, 1998). Parents and teachers worry about students' low achievement which might occur as the result of lower attention and less time spent on study or homework, given more time spent on computer games. Anderson and Ford found that the attention problem was related to electronic video games (as cited in van Schie & Wiegman, 1997). MacPherson (2004) said that children are developing a 'problem solving deficit disorder' or lack of imagination and creativity which are essential for children's development of problem solving skills as results of playing computer games.

The results of the intervention of computer technology or computer games are not concurrent but various and controversial. Some research shows the improvement of children's creativity after use of computer technology or computer games (Clement, 1991; Escobedo, 1992; Tuzun, 2004; White, 1981), while other research shows that there is no difference of children's creativity after use of technology (Proctor & Burnett, 2002). Ellis (1984) found that there is no negative correlation between computer games and school achievement and there is no evidence of addiction (Roe & Muijs, 1998; van Schie & Wiegman, 1997).

Even though children already frequently use computer games, there is not much research about their impact on the children and their cognitive development areas such as creativity. Some research from sociology and communication areas seems to have begun to view computer games as a prevailing social phenomenon, but not from education sources. What is the impact of computer games on the children's physical, emotional, social and cognitive development, especially children's imagination and creativity? How are computer games correlated with children's creativity? Proctor and Burnett (2002) argue the need of studying the effects of computer games as following:

> The nature of the computer experience that students receive in elementary schools must be evaluated. What effect will these computers have on our students, teachers, schools and communities? How do we best implement curriculum initiatives in order to optimize the educational benefits for each individual student? (p. 46)

Today's society demands a creative and novel resolution to problems, which requires creative thinking and problem solving (Saracho, 2002). This current research project is designed to explore the relationship between computer games (children's time spent on computer games and different genres of computer games), TV and free natural play time, structured activities, which students have after school privately and children's creativity to optimize their educational benefits.

Statement of the Problem

In Korea, 96.34% of ages 9 to 13 children have experienced computer games, while 84.4% of elementary school students have experienced internet games, and their average playing time for one internet game was reported as 1 hour and 24 minutes by the

research of the Korean National Educational department (Game Development Industry Total Information Sharing System [GDITISS], 2004). Healy (1998) cited Bill Mckibben's observation of children as follows that "He laments our children's separation from nature and real life lesson such as patience and limits learned from interacting with the physical world" (p. 30). There have been some small or big physical arguments or acts of violence among children or teenagers because of items or virtual money transaction during computer games (Lee, 2004). One teenage boy killed his brother to want to know how it would be in a real setting if he might kill somebody like computer games in virtual setting (Youm, 2001). Similar aggressive children's violent crimes affected by video games were also reported in Japan (Sakamoto, 2000). Individuals accused of recent school shootings in United States (i.e., Paducah, Kentucky, Jonesboro, Arkansas, and Littleton, Colorado) were reported to have habitually played violent video games (Anderson, 2002; Anderson & Bushman, 2001; Singer & Singer, 2005). Recently, one early 20's Korean military soldier at a Ground Post (GP) near the Demilitarized Zone (DMZ) in South Korea shot and bombed his colleague soldiers who were sleeping at night. There has been a social controversy in finding the cause of this crime (i.e., was it caused by his personal or characteristic problem to deal with stress or by his being a devotional computer gamer and aggressive violence affected by computer games?).

Like Mckibben's comment (Healy, 1998), Korean teachers complain about the trend of children's aggressiveness, impatience, and ignorance of how to play without computer games. Is this a changing phenomenon from analogue to digital time? When TV was first developed, there had been many concerns about TV's impact on children's

development. Is this the same worry, only changing from TV to a computer as a medium?

Computer games seem to create a new social interaction in the virtual settings (Kee, 1986). Some parents allow their children to play computer games because of worry about the isolation of their children from the main stream, despite their concern about the tendency toward aggressiveness. Parents need guidelines to help their children gain maximum benefits from computer technology to facilitate their cognitive, social and physical development. With thought, planning and good sense, parents, teachers and educational administrators should be able to help children develop minds that are able to deal with the challenges of future technology.

To establish these guidelines, there is a need to conduct research about the nature of computer game elements and how these elements affect children's creativity and their development. Computer games seem to provide imagination, motivation, and challenge to children. Most internet games are played with other children in a virtual setting. Computer games provide a collaborative working environment to make a winning strategy with another player distant from the children. How do these characteristics affect children's creativity? How does a computer game provide the chance to engage in collaborative problem solving? We need to know what computer games consist of and analyze the elements of the games. There are a few studies about the effect of educational computer games on children's development but even fewer about the nature of computer games. Do they affect children's creativity and the process of problem solving in the same or different ways?

In South Korea, most children play computer games, especially online games. But in Japan, video games are more popular (Novak, 2005). Novak identified the cost of internet use as the main cause. Thus patterns such as preferred platforms or genres of computer games can be different by various social or cultural situations. Is there a different pattern between rural and urban children regarding playing computer games? Is there a different pattern among the different school grades or gender playing computer games? How do children's achievement and parental SES correlate with computer games?

There is another factor that reduces children's natural play other than computer games in South Korea. Most Korean students have many structured after school private education activities (structured activities) in various subject areas - English, mathematics, science, Korean, Chinese, computer, arts, music, athletics, etc. E. Kim (May 3, 2005) reported that 9 out of 10 Korean elementary school students were taking structured activities and children could only have 179.48 minutes (less than 3 hours) a day as their free time without any study, based on the data of Hangil research. These structured activities reduce their free time to play with friends outside or to imagine or to engage in divergent thinking by themselves. Torrance (1963) mentioned that "too much pressure on children to learn academic subjects tends to prematurely stifle fantasy" (p. 80). For their children's future, parents have invested lots of money and children's time with these structured activities. The Korea National Statistical Office [KNSO] (2004) reported that Korean parents' expense for structured activities exceeds more than total government budget for public education. But we don't know how these structured activities affect children's creativity, even though it has been a social controversial issue

in Korea continuously because of parent's financial burden and children's lack of free time.

Purpose of the Study

The purpose of this study is to conduct research regarding the relationships among creativity, computer games, children's natural play and their structured activities by the analysis of time spent on computer games, structured activities, TV and children's free play respectively. The results will be analyzed to include gender, location, grade, achievements, and parental SES.

Research Questions

1. How is children's time spent on computer games, structured after school activities and their free natural play related to their creativity?
2. Are there interaction effects among kinds of structured after school activities, genres and platform of computer games, gender, school, school achievement and parental SES to creativity scores?

Definition of Terms

1. The Figural and Verbal Forms of the *Torrance Tests of Creative Thinking* (TTCT) (1974a & b): The Torrance tests measure the ability of the child to think creatively in either non-verbal or verbal modes. They measure different aspects of this ability: fluency-how many original ideas the child had, flexibility-how varied these ideas were (one from the other), originality-how original the ideas were when compared to a normative group, and elaboration-how many details were added to the main idea (Clements, 1991).

2. Creativity is defined by Torrance (1988) as "a process of sensing difficulties, problems, gaps in information, missing elements, something new; making guesses and formulating hypotheses about these deficiencies; evaluating and testing these guesses, and hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating the results" (p. 47).
3. Creative Problem Solving is both a diverging and a converging activity with six stages: mess finding, data finding, problem finding, idea finding, solution finding, and acceptance finding (Isaksen & Treffinger, 1985).
4. Computer games are interactive entertainment software played on various electric platforms such as personal computers, game consoles (e.g., Sony's Play Station 2, Microsoft's X-Box, Sega's Dreamcast, etc.) or handheld devices (e.g., Nintendo Game Boy, mobile games using cell phones, or PDA) and "involving one or multiple players in a physical or networked environment" (Newman, 2004, p. 27). In this context, a game is defined as "any context (play) among adversaries (players) operating under constraints (rules) for an objective (winning, victory, or pay-off)" (Gredler, 1994, p. 13).
5. Natural play is defined by Dewey (1913) as "a name given to those activities which are not consciously performed for the sake of any result beyond themselves; activities which are enjoyable in their own execution without reference to ulterior purpose" (p. 725). Natural play makes children engage in authentic, spontaneous play with the narratives, symbols, and scenarios of their play to develop their imagination and autonomy (Goldstein,

Buckingham, & Brougére, 2004). Saracho and Spodek (1998) defined play as "a natural activity and assists individuals in understanding and depicting their world, at both thinking and feeling levels" (p. 8).

Limitations

There will be some possible limitation in this study:

First, the time data based on children's questionnaire might be expressed subjectively. Because the students are young, they may make some mistakes or have some difficulty describing their actual time for computer games or their time spent on after school educational activities. This may decrease the validity of this study.

Second, there is difficulty in distinguishing the effect of different genres of computer games, because children don't play only one game during one time on computer games. They often play the various genres of games at one time.

Third, this is not laboratory based research, so the researcher can't control any variables relating with students' time or computer game settings in this study. This study can only partially describe the relationship among time spent on computer games or free play time or structured activities and creativity.

Fourth, this study will collect data from some South Korean students, so that there may be some limitations of generalizing the results.

Fifth, this study didn't consider the other factors to affect children's creativity like teacher's attitude, different school environments, children family or neighbors, or psychological conditions (e.g., motivation, aggression, depression, self control, etc.). The students are divided only by the variables of time spent on the computer games, after school educational activities, free play, and TV , by the variables of gender,

location, grade, parental SES (in this study, fathers' education level used), and the genres of computer games to research about the relationship between the amount of time spent and creativity. We are quite sure that there can be other factors that affect the children's creativity.

Sixth, observations of how children play computer games were not conducted, due to time limitations and the students' busy schedule. Observation of children's playing computer games in natural settings at home or arcades like PC rooms may give full descriptions of the effects of computer games on children.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter will review the literature regarding controversial point of views toward the effects of computer games and children's creativity from a developmental point of view. First, the researcher will assess how play is working for children's development of creativity. Second, the relationship between parental SES and creativity will be reviewed. Third, the characteristics (i.e., contents, genres, and platforms) of computer games and their relationship with children's creativity will be considered. Finally, review about brain theory, which is still not verified, but asserts for the effects of computer games to children's brain development will be followed.

Children's Natural Play and Creativity

Play as a Developmental Tool

Children grow with playing without or with purpose, and play is natural and necessary in their development. Play gives children joy, amusement and motivation so that it encourages them to continue playing. Through play, children develop their cognitive, social, physical, and emotional abilities. Galiguzova (1995) described that children's play is filled with repetitions of and imaginations based on what they have heard, seen, and experienced. Play is a method for children to investigate their surrounding world with fantasy and creativity. Anderson, Huston, Schmitt, Linegarger, and Wrigest (2001) mentioned that "creativity by young children may be manifested most obviously in imaginative play, that is, where children generate roles, characters, objects, and plots" (p. 69). They need the hands on approach to their world with enough

human touch. The 1990 Tokyo International Conference on the Children's right to play discussed the lack of material resources for children's creative play (Morris, 1990). Children use material objects for their pretend play or make-believe play. Through their play, they imitate and repeat what they have seen, heard and experienced. They associate together what they learned and experienced and create new ideas or games. Thus rich atmosphere for play with materials and time can give children much experience to develop their creativity. Inciting the 1989 adoption by General Assembly of the United Nations of the Convention on Children's Rights, Morris (1990) said that "Play is an educational process of fundamental importance and the birthright of every child" (p.1).

Children play not only for ontological reasons to learn social and cognitive skills for survival, but also for natural reasons to have fun, freedom, joy and passion, realizing at the boundary of real and not real world with internal motivation (Vanderberg, 1998). Children's play provides cognitive, social, emotional and physical developments. Gelfond and Salonius-Pasternak (2005) described the contributions of play such as "emotional regulation, peer and familial relationships, attention, problem solving, creativity, fine and gross motor skills and overall physical health" (p. 493). Russ (1996) pointed out that personality and affective processes are important into creative process, such as motivation, curiosity, self-confidence, and tolerance of ambiguity. Thus, we can say that children's pretend play consists of affective and cognitive processes in the creative process. Play experience with materials and time seems to be necessary for children's emotional, social and cognitive development (Singer & Singer, 2005).

Freud, Piaget, and Vygotsky

Freud, Piaget, and Vygotsky seemed to agree that children's play is important to develop creativity. They agreed regarding the importance of play in children's creativity development but have different point of views about creativity. Freud explained creativity with interminglement with consciousness and unconsciousness for wish fulfillment (Ayman-Nolley, 1992; Vanderberg, 1998). But Piaget and Vygotsky didn't agree with Freudian view, which regards creativity as an unconscious process. But Freud and Piaget regarded children's symbolic play as a distortion of reality which would be disappearing later (Singer & Singer, 2005).

Piaget saw play as involving a mix between processes of accommodation and assimilation. Play is a child's natural and developmental process of learning. Through play, children develop their social, emotional, physical and cognitive development (Vandenberg, 1998; Wohlwill, 1988). Piaget stressed the natural play without adult's interference and direct experiences through physical and social activity may develop children's cognitive development without structured educational forms (Smolucha, 1992). Without an adult's direction or educational recitation, spontaneous and free natural play to interact with their surrounding enables children to develop their cognition (Crossman, 2004). Piaget's creativity may be subjective and stress a reasoning and logic development. He regarded that children's make believe or pretend play be ended when children turned into the stage of games with rules from the symbolic and make believe stage (Scarlett et al., 2005). He highly viewed creativity as subjective transformation of reality toward mature logical thought (Ayman-Nolley, 1992). Scarlett et al. (2005) disagreed with Piaget that "today's cognitive development psychologists argue that

imagination continues to develop well into adulthood as evidenced by how imagination operates in older children's and adolescent's play" (p.10).

Saracho and Spodek (1998) repeated the role of play defined by Vygotsky as that "through play, children use their ingenuity to create imaginary events that originate from real life circumstances. Play also liberates individuals from the constraints of the real world that surrounds them" (p. 7). Vygotsky stressed the scaffolding from adults. In Vygotsky's point of view, children develop their creative imagination through playing of substitution or pretending play through the interaction with other adults or friends (Smolucha, 1992). Children develop their creativity through the interaction with the more experienced or matured adults or peers to see how to create new ideas or imagination in a zone of proximal development (Z.P.D.) In Vygotsky's (1932) study, rich experiences, especially social experience which was a factor to influence the development of creativity, and language development and schooling as two major factors influencing creativity, are important (as cited in Ayman-Nolley, 1992). Piaget regarded that children's make believe ends when they begin the stage of games with rules from the symbolic and make believe stage, but Vygotsky argued that make believe play keeps on going to older childhood, adolescence and adulthood, using imagination (Scarlett et al., 2005). Vygotsky's play consists of imagination and reasoning, social interaction with adults or advent peers in the surrounding world.

The content or nature of creativity may be changed by children's development and environmental influences. Healy (1998) mentioned children tend to choose an entertaining visual task over a more taxing linguistic one. Vygotsky pointed that "children's work is more figural and less literal than the higher level presentations

present in works of creativity later in life" (cited in Ayman-Nolley, 1992, p. 80). Figural creativity may develop earlier than verbal creativity.

Decline of Creativity in a Certain Period of Childhood

Some researchers have reported a decline of creativity in certain period because of suppression by schooling (Csikszentmihalyi, 1996; Sternberg & Lubart, 1995; Torrance, 1995; Wohlwill, 1988). Torrance (1965) mentioned similar creativity decline in middle childhood may be caused not by cognitive development but by social conformity pressure. Torrance's study found that "Creativity scores for both sexes became consistently lower after third grade" (as cited in Dacey & Lennon, 1998, p. 72). A study carried out by Dacey and his colleagues at Cornell University showed that the distribution of creativity score for their twelve hundred seventh and eighth graders was not normally distributed like other human traits are. The distribution of the students in middle score range was fewer in their study. Dacey and Lennon (1998) conjectured the reason as the following statement:

> The suppressing effect of school is only powerful enough to affect some of the students-the bottom three-fourths…those in the top quarter of creative ability are relatively impervious to the effect. They would go on being creative no matter how they are treated by the school system. (p. 74)

Gardner reported a U shaped model for artistic creativity (as cited in Smolucha & Smolucha, 1985). His study reported the decline of artistic creativity during the ages 7 through 11. Smolucha and Smolucha described the development of artistic creativity as a J-shaped model based on their experimental study, which asked to make many different things form given 8 geometric shapes to measure fluency and flexibility, similar with the

Figural *Torrance Tests of Creative Thinking* (TTCT). These studies mentioned certain diminishment of the development of creativity in certain period, especially middle or late childhood.

Parental SES and Creativity

Can social, cultural and environmental factors which affect the patterns of children's play and their amount of time spent on different activities influence the development of children's creativity? Today, in developed countries or in educationally competitive Asian countries like Korea, it seems to be more proper to conjecture about the lack of their free play time rather than their lack of play materials. Children are spending more time on structured educational activities after school and less time on physical activities with other children or on thinking or imagining by themselves. Parents' preference of academic excellence, exam oriented educational system and competition for success in the schools cause an emphasis on work over play. Direct instruction through spending more time on academic work with private tutors individually or groups is believed to be a more effective way for the children to have the competitive ability. Children learn from imitating more skillful adults (like paid tutors at structured after school private education), instead of through exploration or play (Gardner, 1989). Children with heavy structured activities can gain much knowledge. These structured activities totally depend on parental financial condition and their priority. The KNSO (2004) reported that parents in Seoul spend more money on their children's structured activities than those in other areas. It also shows that parents with a B.A. or higher degree spend more money on their children's structured activities than those with a lower education diploma.

More parents want their children to stay indoors with structured activities. Also, students with more structured activities tend to have more supervised and controlled time by parents. They prefer children's staying at home with computer games for safety reasons or for expectation of children's exposure to technology earlier to playing outside or "hanging out." McHale, Crouter, and Tucker (2001) found that "amount of free time available to children has become a result of social class differences. Free and unsupervised play in late childhood has often been connected to problems such as poverty" (p. 77). Bickman, Vandewater, Huston, Lee, Caplovitz, and Wright (2003) reported that low income and low parental education was associated with extensive watching of TV and playing video games because of lack of other recreational facilities or other activities. Posener and Vandell's (1999) study also found that children with much free time tend to have the families who can't afford educational activities to take children's play time. Roe and Muijs' (1998) study showed that "parental SES indirectly affects computer game use" (p.195). Children with low SES parents tend to play computer games more in their study.

Children can't find the time to play with other children so that they play computer games between the break of structured activities. How does this time spent on more academic work and computer games rather than playing with other children or "hanging out" by themselves influence their creativity? The period of starting computer use and the condition of playing computer games are also related with parental SES because children can use a computer or play computer games at home when their parents can provide enough money for computers or online connections. Social and economic

differences among children can be reproduced by access to computer and internet use (Lowe, Krahn, & Sosteric, 2003; Roberts & Foehr, 2004).

Some researchers (e.g., Dacey & Lennon, 1998; Ward, Finke, & Smith, 1995) agree that most people are alike in their cognitive abilities, but individual differences in creativity may depend on acquired knowledge, experience, and how knowledge and experience are used. Creativity doesn't come from nothing but from former experiences or some already existed information or knowledge through distant or remote association and through conceptual combination (Ward et al., 1995). It is the cognitive process of making new or unusual things or ideas based on existed knowledge or experience. Dacey and Lennon (1998) pointed out that "creative potential is probably normally distributed across all social and economic levels, but those who have more resources to develop those qualities are more likely to reach their potential" (p. 242-243).

Computer Games and Creativity

Two Different Attitudes toward Computer Games

How are children's play in natural settings and playing with computer games the same or different? Is playing with computer games actually a kind of "play"? Healy (1998) described concerns about playing computer games that heavy computer users show some difficulty in controlling the time spent on computer games because of their addiction to computer games. They are lacking in play with other children and reading. They are uninterested in reading or in most of other school activities (Singer & Singer, 2005). They react to emotional stress like a much younger child and have social problems. Many parents and teachers have been concerned about the effects of computer games on children's development because of these concerns. Simon (1985) classified

two concerns. One is whether computer games lessen or disrupt children's play and direct learning experience. The other is whether computer games provide some inappropriate influence (like aggression) to children.

Based on Bandura's (1973) social learning model, there has been long and deep concerns about the effects of playing computer games with violent content. Anderson and Dill (2000) reported the exposure of violent video games increases violent behaviors. Another research study using meta-analysis, which tested the effects of violent video games on children's aggressiveness in laboratory and field settings, reveals that exposure to violent video games increases children's aggressiveness and decreases pro-social behavior (Anderson & Bushman, 2001). However, some researchers argue that violent content in computer games are different than actual aggression (Gelfond & Salonius-Pasternak, 2005; Goldstein, 1994; Pellegrini, 2003; van Schie & Wiegman, 1997). Newman (2004) incited Emes' study that "having aggressive thoughts after playing video games does not necessarily translated into aggressive behavior" (p. 67). Researchers favorable toward computer games pointed out children can distinguish differences between virtual and actual aggression in real settings. Gelfond and Salonius-Pasternak's (2005) study said that the violent content computer games provide may affect children differently by the children's characteristics and the effects of violent computer games are less than those of violent TV programs. Recent research show positive benefits of computer games (Roe & Muijs, 1998; Sϕrensen & Jessen, 2000).

Gelfond and Salonius-Pasternak (2005) answered these concerns and argued why computer games can be considered as a children's play. They said that most American children are playing computer games, children regard computer games as play and

"computer games may enrich children's play by offering new ways for children to pursue developmentally appropriate experiences (i.e., imaginative play, negotiating rules, and safe exploration of aggression.)" (Gelfond & Salonius-Pasternak, 2005, p. 492). Escobedo regards computer games as children play because computer games have the same phrases of children's play, which has "exploration of material through inspection; manipulation, including experimentation if possible; and meaningful play" (Escobedo, 1992, p. 124). Wohlwill's description of play phases was cited by Escobedo, which are "the kinds of elaboration of reality that qualify as play, such as the transformation of objects for constructive purpose, or for the creation of an imaginary or pretend world, appear after exploration" (p. 124). Children play for fun and interaction with others. Children's play seems consist of fantasy, collaboration, cognitive development and emotional passion.

Scarlett et al. (2005) described the reasons for children's playing computer games in such terms as their graphics and realism, their levels or graded challenges, and their ways of interaction. Computer games provide children fantasy and realism which can make them feel real and vivid during playing computer games (Bergmann, 2001; Gelfond & Salonius-Pasternak, 2005). They provide creativity, imagination, motivation, interactive collaboration and ownership to children (Tuzun, 2004).

Ownership

Computer games provide many levels or graded challenge so that children choose their proper level to make a strategy for winning. Dimensions of control which computer games provide children may bring different results (Hofmann, 1986). Children feel ownership because they can control the game to choose their levels and can aim to

improve their level. Diverse levels challenge children and give them motivation to improve their level. Sherry (2004) reported that the challenge that computer games provided is the most appealing factor and computer games increase self-esteem after gamers fulfilled certain challenges or goals that the games provided. Computer games provide children an opportunity to create their own strategy for improving their level in many different ways.

Freedom and Autonomy

Computer games also provide young players ownership, autonomy, independence from adults and self control through games (Hofmann, 1986). Ownership of playing computer games provides a sense of free choice of doing computer games, selecting games, and how to play the games. Rejskind (1982) describes the good atmosphere for developing creativity as to give proper freedom to children without asking conformity and sees the relationship between freedom and creativity as curvilinear. Parents or any adults can't control children's management of computer games. Computer games provide children a free atmosphere without any control from adults. It is a totally different new world to give children ownership to control the games. Free atmosphere provides a rich environment for creativity. Gelfond and Salonius-Pasternak (2005) expect that computer games may have some potential to restore the lost critical elements of children's play because of structured activities and restriction of children's time and imagination influenced by these activities. Computer games may provide those who play computer games with time and opportunity to be imaginative, adventurous, and free, which doesn't seem to be allowed to children because of their highly supervised time (McNamee, 2000). Bergmann (2001) described the

characteristics of computer games (such as contents free from reality and no restrictions for imagination and adventure in fantasy worlds), which attract children.

Interactions with Other Children

Online computer games can make it possible to interact together with other children who are known or not during computer games. Online games provide collaborative work with others too. Newman (2004) describes computer gamers' social and interactive activities as "players indicated the ways in which they learned from others, and helped others to learn, by sharing information on strategy and technique through talk and observing of the play of others" (p. 149). Greenberg (2004) pointed out the main reason for children's playing computer games as social aspects of computer games which generate friendship, social events and common interest that often goes beyond the playing itself. Children produce the winning strategy together during the computer games by chatting, or by telegram (Tuzun, 2004). Computer games provide a virtual place to meet and play with friends. Computer games provide the natural way of textural communication and especially in multi-player games, social skills are needed or must be developed (Aarseth, 2001). Even some researchers argued the hypothesized link between frequent computer game play, social withdrawal and isolation can be no longer supportive (Emes, 1997; Kestenbaum & Weinstein, 1985). Sakamoto's research found "a reverse causal relationship in which elementary school students with lower social adjustment tended to play video games" (Sakamoto, 2005, p. 13), i.e., they choose to do so. As a matter of fact, children are not playing alone at computer games, but play with others to produce a winning strategy. If they are good at playing computer games, they gain popularity and respect easily from peers.

Fantasy

The contexts of computer games provide fantasy, curiosity, concentration, uncertainty, ownership, and simulations, which can't be experienced in the real world. Because of that, there has been a concern of possible confusion between reality and an impossible virtual world. Gelfond and Salonius-Pasternak's study (2005) dismisses this concern about children's possible confusion between virtual fantasy and reality because "children can distinguish between fantasy and reality, make sense of real-world rules, and gain a sense of mastery over difficult issues" (p. 494).

Motivation

Computer games involve children in solving problems creatively with fun (Betz, 1995). Krasnor and Mitterer mentioned that children can enhance hierarchical thinking ability while solving problems if computer programs or games are used at an optimum level (as cited in Simon, 1985). Computer games provide different problems at the next screen just after they finish solving problems at the previous screen (Bergmann, 2001). Multimedia features of the game positively impact the motivation of the game players (Prensky, 2002; Tuzun, 2004). Graphical and audio stimuli provide enough motivation for them to engage participation in the game. The challenging contents, scores or war items of computer games also encourage children to continuously participate in computer games.

Flow and Computer Games

Csikszentmihalyi (1990) defined flow as enjoyment occurring when people go beyond what they are programmed to do and achieve an unexpected task. Csikszentmihalyi's flow has some characteristics similar to what we can find during the

children's computer games, including a balance between the challenge of the activity and the skills of the individual, merging of action and awareness, clear goals and feedback, concentration on the task at hand, control over actions, loss of self-consciousness, and transformation of time (Dietrich, 2004; Tuzun, 2004). During the computer games, children may display behavior similar to Csikszentmihalyi's concept of flow (Sherry, 2004). Children start computer games themselves with self motivation and are completely involved in the game with full concentration. They enjoy the challenge when computer games ask them to solve a problem with some strategies.

Genre of Computer Games and Creativity

Genre of Computer Games

Computer games can be classified by places as arcade games, and home personal computer games or classified by platforms such as game consoles (e.g., Microsoft's X-box or Sony's Play station 2), handheld devices (e.g., Nintendo's Game Boy, Personal Digital Assistants (PDA), Mobile phones, etc.), and personal computers (CD or online games). We also classify computer games by their genres. The genres of computer games classify the games by "categories based on a combination of subject matter, setting, screen presentation/format, player perspective, and game-playing strategies" (Novak, 2005, p. 85). Bates (2004) divided computer games such as Adventure, Action, Role Playing (RPG), Strategy, and Simulation, etc.

An Action game is a real time game which doesn't require deep thinking, but reactions to the screen and quick tactical thinking. These games consist of plat formers, 1st or 3rd person shooters, or racing, or fighting. Action games are usually first person shooting games (Chamber & Smith, 2000). Most goals of action games are to destroy

enemies, while avoiding being destroyed. Action games require only quick reaction and eye-hand coordination (Novak, 2005).

Adventure games are story based and usually rely on solving puzzles and exploration. They are not in real time but contain strong story lines to require a long time, like one week. Novak (2005) described the characteristics of adventure games as "exploration, collecting, puzzle-solving, navigating through mazes, and decoding message" (p. 89). Adventure games ask gamers to demonstrate skills to overcome many obstacles (Kafai, 1998). Because of asking player reflective thought, adventure games and action games are different. Gamers who prefer adventure games tend not to play action games.

Role playing games (RPG) make players expect to choose one of characters and manage it during the game. The relationship between a player-chosen character tends to be strong "because winning is tied with this character advancement" (Novak, 2005, p. 93). Most of role playing games are war games with fantasy literature. Mackay (2001) argued that role playing games provide gamers fantastic, imaginative and free texts to make them pretend a certain character, identify with that character and have freedom from the restriction of reality. Graphics and media which computer games provide make gamers easily become identified with a chosen character during the game.

Wikipedia (August 19, 2005) defines Massive Multiplayer Online Role Playing Games (MMORPG) as referring the role playing games which thousands of other players play at the same time online. Comparing console games which have been developed for single playing, multiple online playing games have been developed for multiple playing, interacting with others. MMORPGs provide scopes for collectivity and

collaboration (Newman, 2004). MMORPG players enjoy the online chatting about real world topics as well as the game during playing the online games. MMOG means Massive Multiplayer Online Games, which is not restricted on RPG but play in other genres of computer games with many players online.

Simulations allow the player to have the replicated systems, machines, and experiences using real world rules (i.e., vehicle, construction, management, sports, and participatory simulation). Simulation games can be used for educational setting to provide students virtual settings to be experienced and learned (Novak, 2005). Studies of freshmen engineering technology students' SimCity 2000 have shown that students learn more about how the whole system works by their separate actions during computer games (Betz, 1995).

Strategy games usually have a military setting and are played to manage a player's resources (e.g., troops, units and weapons) in a limited time. Players' proper decision to manage the resources and time are critical to win a game.

Bates (2004) explained a casual game which "is often played in short bursts, during lunch hour or a 15 minute break because players want to get in and have some quick fun and get out" (p. 70). This type of games doesn't require gamers to know strong story line nor much information about the game like adventure games. Casual games provide the virtual context to get high scores and best time with others. That's the reason why many Korean elementary students prefer casual games (K. Kim, August 26, 2005).

Gender, Grade, and Parental SES Differences

Funk, Buchman, and Germann (1997) report that there were different amounts of time spent on computer games according to genders and different grades. Male students

spent more time on computer games than female ones (Petrov, 2000; Roberts & Foehr, 2004; van Schie & Wiegman, 1997). Fourth graders spend more time on computer games than 8th graders in the United States (Funk et al., 1997). Funk et al. also found that there was a notable difference on computer game preference between genders. Buchmann and Funk's (1996) study shows that female students tend to prefer educational games and males prefer more realistic violence. But the preference for educational computer games is decreasing in both genders by increasing age. Eagly's study explains this phenomenon with masculine and feminine stereotype social role theory (as cited in van Schie & Wiegman, 1997). Roberts and Foehr (2004) said that game preference is related to parents' socioeconomic status as well as race or ethnicity. They found that Hispanic children choose games different from white or African Americans, and "children from lower socioeconomic backgrounds might prefer more violent content and that those from higher socioeconomic backgrounds might prefer more cognitively oriented content" (Roberts & Foehr, 2004, p. 130).

According to the different platforms and genres of computer games, the effect on children's cognitive, affective and social development may be different also (Goldstein, 2003). Strategy based games have been found to help cognitive development, especially logic skills (Bruce, 2002). Adventure games require cognitive skills to gather, explore and use information with tolerance of ambiguity (Novak, 2005). But there has not been much research about the effect of different genres yet. Further research about how different game platforms or genres of computer games' effect on children's cognitive development must be studied.

Brain Theory and Creativity

Traditional controversy related with creativity development in the brain is to distinguish brain hemispheric dominance, which creativity process tends to be positively correlated with right brain (Torrance, 1982). But Dacey and Lennon's (1998) study concluded the importance of the whole brain in creativity process, which interacts between both hemispheres after reviewing extensive research.

There is one negative opinion regarding how computer games affect on children's brain development. Akio Mori's study (as cited in Healy, 1998) discussed about heavy computer game user's emotional, social development and creativity based on the brain neurology. Bruce (2002) cited Akio Mori's research that heavy computer game user's and game developer's brains showed some developmental deficiency on the frontal cortex which controls emotion and creativity and is important for cognitive process (Johnson, 2005). After examination of brain waves from the experimental group during computer games and other activities, he found that wave β was not active and wave β and α were overlapped during computer games, which can be found easily among Alzheimer patients (Mori, 2003). Ryuta Kawashima's research reported the similar result with Akio Mori's that computer gamers' brain showed activity associated with only vision and movement not in the prefrontal cortex, compared with the children's brain setting in solving arithmetic problems that showed strong activity in the prefrontal cortex (Holmes, 2005). A recent study by researchers at the University of Indiana Medical School reported lowered activity in the brain's frontal lobes of teenagers who had a history of playing video games (Singer & Singer, 2005).

Dietrich (2004) proposed that there are four basic types of creative insights as deliberate and spontaneous processes and prefrontal cortex instigates the creative process. But Dennis Shutter's study said that the deficient phenomena are as temporal and caused by fatigue and there is no direct evidence for lasting brain damage (Philips, 2002). Vaupel's (2002) study shows that there are no significant differences between computer gamers and non computer gamers of thirty middle school students on their math performance, memory, attention and planning, reading rate and comprehension, as well as beta and theta activity in the brain were collected as pre- and post-test measures.

Dacey and Lennon (1998) describe the strong relationship between rich environments and brain development, especially creative ability because adequate nutrition and educational environment properly provided allow storage of great amounts of knowledge and facilitate new creative productivity. They mentioned the acts of Adrenocorticotropic Hormone (ACTH) as a catalyst or an agent for interneuronal communication between two hemispheres in the brain working at the frontal cortex, though how ACTH plays into the creative process is unclear still. But despite popular assumptions about video games' effects such as aggressiveness, or brain damage, there has not been widely accepted evidence to conclude any reasonable assumption yet.

CHAPTER III

METHODOLOGY

The purpose of this study is to investigate the relationships among computer games, structured after school private education, free play, TV and children's creativity test scores. This chapter introduces the methodology and the research procedures for collecting data to seek to answer the following research questions:

1. How is children's time spent on computer games, structured after school activities, their free natural play and TV related to their creativity?
2. Are there interaction effects among the kinds of structured after school activities, genres of computer games, gender, grade, school achievement, school location, and parental SES that predict creativity scores?

Procedures

Participants

Two hundred and thirty eight elementary students (124 males and 114 females) from two different schools in the Republic of Korea volunteered to participate in this study. They were 115 third grade and 123 sixth grade students. A convenience and purposive sampling method was used to select the two schools. This researcher selected the two elementary schools, which are located in different areas in Korea, to compare the difference between urban and rural elementary students in terms of how they spend their time on computer games, TV, free play and structured after school private education and how they develop cognitively in the area of creativity. Both school groups of elementary students have approximately the same physical age, but different ecological

environments. The urban school is located in the southeast area of Seoul. There are some so called famous 'good high schools' near this elementary school, which is surrounded with many tall apartments and expensive villas. Also, there are some small multiplex apartments and small houses near the school. Two classes per each 3rd and 6th grades were assigned by the school administrator. Total participating students from this urban school were 133 (64 third graders and 69 sixth graders), with 18.8% of the students' fathers having attained Masters or Ph.D. degrees, 68.8% with B.A. degree, 11.3% with a high school diploma and 0.8% with an elementary or a middle school diploma. Parental SES was based on the students' father's education level in this study.

The rural school was selected from Chungbuk Province in the middle area of the Republic of Korea. This school is a twenty minute car drive from the city of Cheongju, which is the capital city of that province. It is around a 2 hour drive from the Seoul Toll gate. There are no stores near this rural elementary school, which are common around urban schools. There are no buildings or houses near the school. The land use near the school is fields for rice, some small farms for vegetables, orchids or small factories. One hundred and five students voluntarily participated in this study (51 third graders and 54 sixth graders). The reason for selecting two different schools located in geographically different areas in Korea was based on the assumption that the students of a rural school might have more time for natural play instead of computer games, and less time spent on structured after school private education than those of an urban school.

Instruments

To assess students' creativity, Activity 5 (Unusual Use of Tin Cans) of Verbal Form B and Activity 2 (Incomplete Figures) of Figural Form B of the *Torrance Tests of*

Creative Thinking (TTCT) (1974a & b) were administered. Activity 5 of the Verbal Form B asks how to use tin cans in unusual ways. Activity 2 of the Figural Form B asks the students to complete ten incomplete pictures using imagination. The reason for administration of only one activity from each Figural and Verbal TTCT was that the subjects of this study could not commit enough time to do the entire TTCT requiring two hours, and the results of these two activities were pretty similar to those of the whole TTCT tests (W. R. Nash, personal communication, January, 2005).

This study was designed to investigate the relationship between children's computer games and their creativity, and between children's structured activities and their creativity. How elementary school students spent their time on a weekly basis on computer games, structured activities which Korean students have privately after school, TV, and free play was assessed for this study. To collect the data of time spent on computer games, structured activities, TV, and free play, a survey questionnaire was developed by the researcher. It included questions about the students' starting period of computer use and purpose, reason for playing computer games, self evaluation about their computer and computer game performance, computer games (e.g., favorite computer games, the amount of time spent on computer games, video games, handheld games, or mobile games), kinds of structured activities and time spent on them, and time spent on outdoor activities or TV or free play (see Appendix A).

Structured interviews were held with 22 students selected using a purposive sample from the subjects of this study based on their TTCT scores, i.e., students who showed high or low fluency in both TTCT-F and TTCT-V; fluency was chosen because of scoring convenience. The interviewees were divided later by time spent on computer

games and structured activities for data analysis to investigate the phenomena of the relationship between computer games and these children's development of creativity. Real interviewees' names were not used in this study.

Parental SES and students' achievement scores in Korean and Math were based on the teachers' reports. The father's education level was used for parental SES. The father's education was based on the teacher's record, which the students had submitted at the beginning of the school year to their teacher. If a student's father doesn't live with him or her, his or her mother's or grandfather's educational level was listed instead. Parental SES data for two classes in the rural school were not obtained because the two teachers didn't give the parental records for the reason of protecting students' personal information. Only 172 students' information about parental SES was used for this study to research the relationship between parental SES and the TTCT scales. Students' achievement scores were based on a standardized exam to show their achievement level of Korean and Math. Each school and grade had different tests so that students' scores were transformed to t-scores with mean of 50 and standard deviation of 10 to be comparable.

Design and Administration

Surveys in the urban and the rural schools were administered on a different day during a week in March, 2005, after getting approval through parental consent forms (Appendix D), and children's assent forms(Appendix F); these forms had been approved by the Texas A&M University Institutional Review Board (IRB). The researcher visited each classroom and administered the TTCT and the survey questionnaire. Each activity of the TTCT was administered in 10 minutes as suggested by the Torrance direction

manuals (1974c). Activity 2 of the TTCT-F was conducted first, and then Activity 5 of TTCT-V. The two TTCT activities were administered first in 20 minutes and were followed by the survey questionnaire, which took 20 minutes. Except for one 3rd grade class at the urban school, there was no other teacher present during administrations of the TTCT and the survey questionnaire.

One week later, the researcher visited each school again one day and conducted interviews with selected students based on their fluency scores as indicated earlier. Group interviews by grade and gender were held because of time limitations. The interviews at the rural school were held at the meeting room for teachers. Because this room was on the first floor, and other classrooms were on the higher floors, the setting was calm and quiet. The meeting room was classroom size. There were wide sofas so that the students and the researcher sat in front of each other. The interviews at the rural school were held with three 6th graders first, then with six 3rd graders later without distinguishing gender. The interviewees were two female and seven male students, and were conducted during class time for approximately 25 minutes per each.

The interviews at the urban school were held in the etiquette room, which was used for the purpose of learning traditional Korean etiquette with traditional costume. The room was wide and separated from other classrooms, so that the interviews could be held without any interruptions. The interviews with four groups were held for about 25 minutes each during an overlap of class and recess time. Six third and seven sixth grade students were interviewed (6 females and 7 males).

The purpose of the interview was to explore the children's culture of computer games and to have the thick description of how children play, enjoy and worry about

computer games based on Spradley's (1979) ethnographic interview method. Appendix B showed the questions the researcher asked the interviewees. Audio recording was made during the interviews. Data analysis was based on the researcher's interview notes and transcripts from audio recordings.

Scoring

The responses of both the Figural and the Verbal TTCT were scored by the researcher for Fluency, Flexibility and Originality (in the Figural TTCT, Elaboration was added) according to guidelines provided by Torrance (1974c). The reliability between even and odd items of each Figural Fluency, Flexibility, Originality, Elaboration, Verbal Fluency, Flexibility and Originality was calculated using the stepped-up Spearman Brown Formula (see Table 1). One Korean doctoral student of Educational Psychology at Texas A&M University scored a randomly selected set of 24 subjects' TTCT tests after being trained. The average of the inter-rater reliability between this Korean student and the researcher on 24 subjects' each TTCT test scores was .97 (see Table 1).

Table 1

Split Half Reliability of the TTCT, Compared to the Normative Sample and Inter-rater Reliability

	Figural TTCT				Verbal TTCT		
	Fluency	Flexibility	Originality	Elaboration	Fluency	Flexibility	Originality
Reliability	.87	.80	.65	.77	.97	.93	.93
Norm Reliability	.87	.84	.79	.50	.63	.60	.71
Inter-rater Reliability	.97	.96	.98	.99	.98	.95	.96

In Activity 2 of the Figural TTCT, there were the four scores of Fluency, Flexibility, Originality and Elaboration. Activity 5 of the Verbal TTCT consisted of the three scores of Fluency, Flexibility, and Originality. Fluency score was generated by counting the number of appropriate responses about each completing the unfinished pictures in the Figural and about usual uses in the Verbal TTCT. Flexibility scores were obtained by counting the number of different categories into which the students' responses fall. The manual provides sixty-eight categories. If the students' response can't be classified into any of these categories, a new category is created and added as a score also. The manual showed some guidelines for scoring Originality as zero, one and two point responses. All other responses showing imagination and creative strength were awarded two points. The scoring of Elaboration is used only in the Figural TTCT. Figural Elaboration scores were obtained by counting the number of detail ideas added to the original figure, such as colors, shading, variations of design, or elaboration of expression, etc. Split half scores by even and odd items on each scale were correlated and put into the Spearman Brown formula. The split-half reliabilities of each TTCT scale in this study and the reliabilities the TTCT norm provided are in Table 1.

Based on students' questionnaire, time spent on computer games, TV, free play and structured activities were coded and added using EXCEL and SPSS. Students spending more than 3 hours a day on computer games or free play or TV or structured activities were labeled the 'heavy' group. The students spending 1 - 3 hours a day on those areas were labeled as the 'moderate' group. The 'low' group included the students spending less than one hour a day on those areas. The Korean Ministry of Education and Human Resources reported that the average of elementary students' time spent on

computer games was 105. 8 minutes a day in 2002 (Korea National Statistical Office [KNSO], 2003), and the Ministry of Tourism and Culture reported that students under age 18 spent about 1-2 hours each day on computer games in 2003 (KNSO, 2004).

CHAPTER IV

RESULTS

The purpose of this study is to employ multivariate and path models using SPSS and AMOS to investigate: a) how children's time spent on computer games, structured activities, their free natural play and TV is related to their creativity test scores and b) if there are interaction effects among the kinds of structured activities, genres of computer games, gender, grade, school achievement, school location, parental SES and creativity scores. This chapter will be organized around the research questions.

Research Question 1

How is children's time spent on computer games, structured after school activities, their free natural play and TV related to their creativity?

Time Spent on Computer Games and Creativity

There was a significant difference between genders in terms of time spent on computer games ($t = 4.514$, $df = 236$, $p < .001$). The fact that male students spent more time than females is similar to other studies (e.g., Funk et al., 1997; Kafai, 1996; van Schie & Wiegman, 1997). There was no significant difference between urban and rural students or between 3rd and 6th graders, even though urban students spent more time on computer games than rural students, and 6th graders spent more time than 3rd graders (see Table 2).

Table 2

T- Tests for Differences between Gender, Location, and Grade on Time Spent on Computer Games

		M	*Mean* Difference	*SEM*	*t*	*d f*	*Sig* (2 tailed)
Gender	M	777.41	395.543	87.617	4.514	236	.000
	F	381.87					
Location	U	594.56	14.975	91.875	.163	236	.871
	R	579.58					
Grade	3rd	589.75	3.480	91.293	.038	236	.970
	6th	586.27					

To test the differences between the three computer game groups (low computer game group spent less than an hour a day: moderate computer game group between one to three hours a day: heavy computer game group more than three hours a day) on the *Torrance Tests of Creative Thinking*, Figural Form B, Activity 2 (TTCT-F) and the *Torrance Tests of Creative Thinking*, Verbal Form B, Activity 5 (TTCT-V), a multivariate analysis was performed. One hundred thirty nine students replied that they spent less than an hour on computer games, 73 between 1- 3 hours, and 26 more than 3 hours a day. No significant differences were found between the heavy, moderate and low computer game play groups on the Figural and Verbal TTCT (Wilks' Lambda = .934, $F = 1.135$, $df = 14, 458$, $p = .342$). Univariate tests between computer game groups on the scores of the Figural and the Verbal TTCT were performed, and one significant result was found: Figural Originality ($F = 3.589$, $df = 2, 235$, $p = .029$). The contrast between the heavy and the moderate game groups for Figural Originality was significant ($t =$

-2.589, *df* = 235, *p* = .01) (see Figure 1). But there was no significant difference between the low and the heavy computer game groups (*t* = -1.615, *df* = 235, *p* = .108). Even though there was no significant difference among three computer game groups on other scores of the TTCT, there was a tendency for the low and the heavy groups to have similar scores and the moderate group to record the least scores in the three Figural scores of Fluency, Flexibility, and Originality on the TTCT, but not Figural Elaboration. Why was there a significant difference between the moderate and the heavy groups rather than between the low and the heavy groups? Other factors (e.g., parental SES or structured activities) may mediate the TTCT scores so that these factors may affect for the low computer group to increase the three Figural TTCT scale scores.

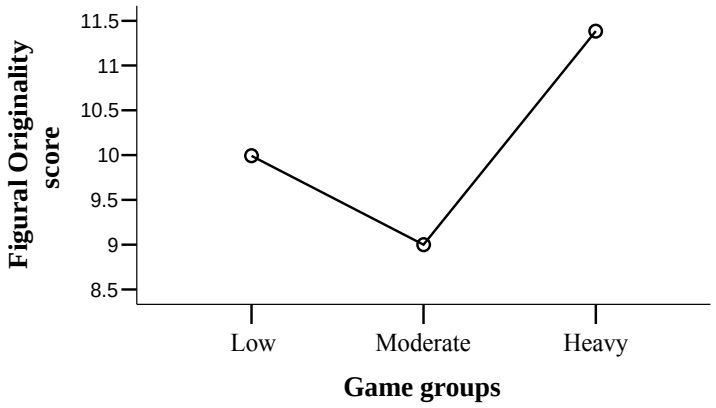

Figure 1. Significant difference between computer game groups on Figural Originality.

Table 3 shows how Fluency, Flexibility, and Originality scores for the Figural TTCT were consistently intercorrelated (.63 < *rs* <. 79). These same three scores for the Verbal TTCT (Elaboration is not scored on the Verbal TTCT) in this study were consistently intercorrelated (.87 < *rs* < .93). The average correlation between three

Figural TTCT scores and the Elaboration score was .26 and .30 between the Elaboration and Verbal TTCT scores. This high redundancy between the three scales (Fluency, Flexibility, and Originality) of each Figural and Verbal TTCT made it possible to simplify the analysis and presentation. The researcher transferred all raw scores of the TTCT to *z* scores and averaged the three Figural TTCT scales' *z* scores except Figural Elaboration as Averaged Figural TTCT, and averaged all three Verbal TTCT scales' *z* scores as Averaged Verbal TTCT. The researcher sometimes used these Averaged Figural and Verbal TTCT to analyze and understand results more succinctly.

Table 3

Correlations among the Scales of the TTCT

		Figural TTCT			Verbal TTCT		
	Fluency	Flexibility	Originality	Elaboration	Fluency	Flexibility	Originality
F-Fluency	-	.794**	.706**	.275**	.125	.170**	.109
F-Flexibility		-	.634**	.183**	.071	.155*	.046
F-Originality			-	.311**	.229**	.255**	.249**
F-Elaboration				-	.299**	.268**	.320**
V-Fluency					-	.917**	.932**
V-Flexibility						-	.865**
V-Originality							-

** Correlation is significant at the 0.01 level (2- tailed)
* Correlation is significant at the .05 level (2-tailed)

The survey instrument filled out by the students indicated that the third graders tend to expose themselves to computers earlier than the sixth graders (median of the 3rd graders' first experience of a computer was age 6-7 but that of the 6th graders' was age 8-9). The correlation between the time of starting computers and time spent on computer

games (r = -.187, p < .01) showed that the earlier children were exposed to the computer, the more time they spent on computer games significant at p < .01. There was a significant difference between four computer staring period groups on time spent on computer games (F = 2.944, df = 3, 232, p = .034) (see Figure 2): group 1, who started computer at or before age 5 years old; group 2, between age 6-7 years old; group 3, between age 8-9 years old; and group 4, between age 10-11 years old. Male students tended to start computer activities significantly earlier than female students (t = - 2.005, df = 234, p = .046) (see Table 4). Especially in urban areas, males started interacting with computers much earlier than females (t = - 2.763, df =129, p = .007).

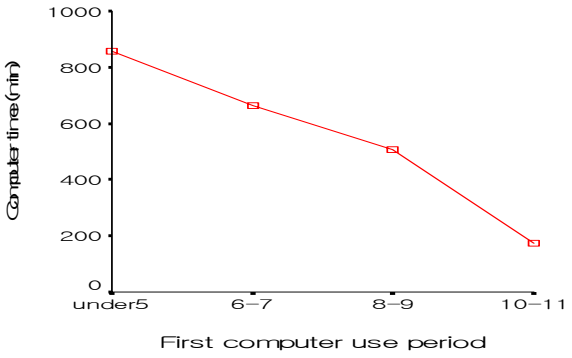

Figure 2. Correlation between starting periods of computers and time spent on computer games.

Table 4

Gender Frequencies for Age of First Computer Use

	Under Age5	Age 6-7	Age 8-9	Age 10-11	Total N
Male	14	54	54	1	123
Female	4	55	45	9	113

Table 5 shows the distribution of the 6th graders' time period of their first use of computers. The multivariate test between the first computer experience groups on the Verbal and Figural scales of the TTCT was not significant. But all three univariate tests between computer first experience groups of the 6th graders on the Verbal TTCT were significant: Verbal Fluency (F =3.331, df = 3, 119, p = .022); Verbal Flexibility (F = 3.332, df = 3, 119, p = .022); and Verbal Originality (F = 2.602, df = 3, 119, p = .055). The late computer experience group, who started to use computers at age 10-11, had higher scores in all the Verbal Scales of the TTCT, and the other computer experience groups had the similar but significantly lower scores in all the Verbal scales of the TTCT. Univariate tests on the Figural TTCT for all four groups revealed no significant difference (see Table 6). Torrance'(1965) study found that there was a significant decline of the TTCT scores for 4th graders compared to younger students because the older students placed a priority on being popular among friends rather than being different, which left them alone and without friends. But there are some significant differences between the 6th and the 3rd students only on the Verbal TTCT scales, not on the Figural TTCT in this study, which will be discussed later.

Table 5

Distribution of 3rd and 6th Graders' First Time Period of Computer Use

	3rd graders		6th graders	
Starting Age	Number	Percentage	Number	Percentage
Under Age 5	11	9.6%	7	5.7%
Age 6-7	72	63.2%	37	30.1%
Age 8-9	29	25.4%	70	56.9%
Age 10-11			9	7.3%

A MANOVA performed on the three Verbal TTCT scales of Fluency, Flexibility and Originality for all three groups from only the 3rd grade students was not significant (Wilk's Lambda = .836, $F = 1.380$, $df = 14, 206$, $p = .165$). Performed univariate tests on the four Figural TTCT scales and on the three Verbal TTCT scales for all three groups from only the 3rd grade students showed no significance (see Table 6).

Table 6

Univariate Tests for Differences among Three Computer Experience Groups for the TTCT Scales

	3rd graders			6th graders		
	df	*F*	*Sig*	*df*	*F*	*Sig*
Figural Fluency	2, 109	2.689	.072	3,119	1.922	.130
Figural Flexibility	2, 109	.918	.402	3,119	1.685	.174
Figural Originality	2, 109	2.471	.089	3,119	2.506	.062
Figural Elaboration	2, 109	.291	.748	3,119	1.577	.199
Verbal Fluency	2, 109	.228	.797	3,119	3.331	.022
Verbal Flexibility	2, 109	.243	.785	3,119	3.332	.022
Verbal Originality	2, 109	.812	.447	3,119	2.602	.055

A MANOVA performed on the TTCT scales for all four groups of computer starting time from only the 6th grade students was not significant (Wilk's Lambda = .793, $F = 1.303$, $df = 21, 325.025$, $p = .170$). But three contrasts were run to contrast group differences. Because three contrasts were run, Bonferroni error rate correction was set at .002 per contrast. Group contrast 1 (C1) between the earliest group (starting under age 5) and the latest group (starting age 10-11) were not significant on all the TTCT scales.

Contrast 2 (C2) between age 10-11 and age 8-9 of first computer experience groups from the 6th grade students were significant on two Verbal TTCT scales; Verbal Fluency (t = 3.099, df = 119, p = .002); Verbal Flexibility (t = 3.139, df = 119, p = .002); not on Verbal Originality (t = 2.734, df = 119, p = .007). Contrast (C3) between the latest group (starting computer at age 10-11) and the other groups was held. On Verbal Fluency and Flexibility, the contrast between the earlier groups of under age 5 and age 6-7 and the group of age 8-9 was not significant. The contrasts among these three groups were not significant on other TTCT scales either. Only two contrasts between age 8-9 group who started to use computer at that time and age 10-11 group were significant.

The group who started to use the computer at age 10-11 attained the highest scores of all on the Verbal TTCT and significantly higher than the group that started using the computer at age 8-9 (C2) (see Table 7). Why the contrast between age 8-9 and age 10-11 of starting computer uses was significant though there is not much difference between the earliest group (under age 5) and the latest group (age 10-11) will be discussed later. Parental SES among the groups except the earliest one was similar. All the students who belongs to the earliest computer use group (n = 12) had the parental SES with B.A. or above.

Table 7

Three Contrasts among Sixth Graders' First Computer Experience Groups for the TTCT Scales

	Contrasts	*t*	*d f*	*Sig* (2 tailed)
Figural Fluency*	C1	.166	13.984	.871
	C2	-2.448	119	.028
	C3	-1.316	11.035	.215
Figural	C1	.347	119	.729
Flexibility	C2	-1.135	119	.259
	C3	.243	119	.808
Figural	C1	.182	119	.856
Originality	C2	.182	119	.046
	C3	-1.053	119	.294
Figural	C1	-.257	10.964	.802
Elaboration*	C2	-.257	9.829	.186
	C3	-1.147	11.978	.274
Verbal Fluency	C1	-2.417	119	.017
	C2	-3.099	119	.002
	C3	-3.035	119	.003
Verbal	C1	-1.891	119	.061
Flexibility	C2	-3.139	119	.002
	C3	-2.733	119	.007
Verbal	C1	-1.681	119	.095
Originality	C2	-2.734	119	.007
	C3	-2.352	119	.020

* Levene's F statistic significant at $p < .05$

Even though there is no difference on the TTCT scales among the experience of computer groups at the 3rd grade students, the 6th graders show a significant difference between early computer experience groups and the latest computer group on the Verbal TTCT scales. Table 8 shows that the 3rd grade students had significantly higher scores

than the 6th grade students on the Verbal TTCT scales and Figural Elaboration; F-Elaboration (t = 2.658, df = 236, p = .008); V-Fluency (t = 3.977, df = 236, p< .001); V-Flexibility (t = 2.278, df = 236, p =.024); V-Originality (t = 4.202, df = 236, p< .001). If computer use influences children's creativity in certain way, 6th graders have used the computer longer than 3rd graders so that been influenced more than 3rd graders. Whether the reasons for this difference are related with developmental phenomena (Torrance, 1965), social isolation by using computer, creative personality without following the main stream to be exposed oneself to computers, parental SES, or other environmental factors, etc. will be discussed later. There is no significant difference among parental SES groups on first computer experience (F = 1.902, df = 4, 169, p = .112). Thus, it might be supposed that the students who start late computer may get higher Verbal TTCT scores because they may not want to confirm the culture of exposing or using computer earlier. Thus, developmentally 6th graders show some decline in the TTCT scales but this group who started to use computer age 10-11 gets higher scores on the Verbal TTCT scales among other groups in the 6th graders.

Table 8

Grade 3-6 Differences on the TTCT Scores

	df	*t*	*Sig*
Figural Fluency	*1,236*	*-.610*	*.543*
Figural Flexibility	*1,236*	*-1.519*	*.130*
Figural Originality	*1,236*	*-.688*	*.492*
Figural Elaboration	*1,236*	*2.658*	*.008*
Verbal Fluency	*1,236*	*3.977*	*.000*
Verbal Flexibility	*1,236*	*2.278*	*.024*
Verbal Originality	*1,236*	*4.202*	*.000*

Time Spent on Structured Activities and Creativity

Mean time spent on structured activities in this study was 8.7 hours a week. Thus, average students in this study spend their time at least more than one hour a day on structured activities.

There was a significant difference between grades (t = -5.217, df = 236, p< .001). Sixth grade students (M = 11.12 hours a week) spent more time on the structured activities than 3rd graders (M = 6.05 hours a week) in this study. Grade 6 students spend more time on structured activities than grade 3 students. This data has the same result as a research conducted by Korea Social Research Center (2005). They found that elementary students spend more time on structured activities than middle or high school students because elementary school classes end earlier. The research conducted by Korea Social Research Center (2005) showed that the higher students' grade is, the less time they are spending on structured activities but the more time on their own self study. Parents in this study seem to make 6th grade children have more structured activities to prepare for heavy scheduled middle schools.

There was a significant difference between parental SES groups (F = 2.514, df = 4, 167, p = .044) on structured activities in this study. The contrast between the students with the higher educated parents (B.A to Ph.D.) and the students with less high education parents (high school diploma or less) spent more time on after school education was significant (t = 2.659, df = 167, p = .009). There was no significant difference between locations or genders on time spent on structured activities (see Table 9). But this research didn't ask how much students pay for their structured activities. Even though tuition fees, kinds, or even quality of tutoring may be different, there was

no significant difference between urban and rural students' spending time on after school educational activities.

Table 9

Differences due to Grade, Gender, and Location on Time Spent on Structured Activities

	t	*d f*	*Sig* (2 tailed)	*Mean* difference	Std. error difference
Grade	-5.217	236	.000	-303.79	58.231
Gender	-1.398	236	.163	-85.63	61.264
Location	1.281	236	.201	79.01	61.679

The group was divided by amount of time spent on structured activities. The students who spent more than three hours a day on after school education comprise the heavy structured activity group, the students between 1 to 3 hours a day, the moderate structured activity group, and the students who spent less than 1 hour a day are the low structured activity group. The average time spent on structured activity was 1.4 hr a day and the median, .86 hr a day in this study (see Table 10).

Table 10

Mean and Median of Time Spent on Computer Game, Structured Activities, TV, and Free Play per Day

	Mean	Median
Computer game	1.4 hr	.86 hr
Structured Activities	1.2 hr	1.07 hr
TV	2.3 hr	2 hr
Free play	1.9 hr	1.5 hr

Multivariate tests between structured activity groups on the TTCT-F and the TTCT-V scores were significant (Wilk's lambda = .881, $F = 2.134$, $df = 14, 458$, $p = .009$). Table 11 shows that one univariate test between structured activity groups on Figural Flexibility was significant. Multivariate tests between structured activity groups on the averaged scores of Figural Fluency, Flexibility and Originality of the TTCT, and the average scores of Verbal Fluency, Flexibility, and Originality, not including Figural Elaboration were significant (Wilk's Lambda = .957, $F = 2.604$, $df = 4, 468$, $p = .035$) (see Table 12). One univariate test between structured activity groups on the averaged score of Figural Fluency, Flexibility, and Originality was significant ($F = 3.058$, $df = 2, 235$, $p = .049$) (see Table 12). Students who spent more time on structured activities scored higher in all four scores of the TTCT-F, even though the other univariate tests were not significant.

Table 11

Univariate Tests for Structured Activity Groups' Differences on the TTCT Scales

	df	*F*	*Sig*
F-Fluency	2, 235	2.328	.100
F-Flexibility	2, 235	6.011	.003
F-Originality	2, 235	2.137	.120
F-Elaboration	2, 235	.221	.802
V-Fluency	2, 235	1.585	.207
V-Flexibility	2, 235	1.111	.331
V-Originality	2, 235	1.284	.279

In the TTCT-V, the low structured activity group had the higher scores than the others. The heavy structured activity group tended to have similar or lower score than the low structured activity group in all three Verbal TTCT scales (see Figure 3). It seems that time spent on structured activity may suppress the Verbal TTCT or low structured activity group may be influenced to increase their Verbal TTCT scales by other factors like TV or computer games or free play.

Table 12

ANOVA for Effect of Structured Activity Groups on the Averaged TTCT-F and the Averaged TTCT-V

		SS	*df*	*MS*	*F*	*Sig*
Averaged TTCT-F	Between Groups	37.118	2	18.559	3.058	.049
	Within Groups	1426.184	235	6.069		
Averaged TTCT-V	Between Groups	80.925	2	40.462	1.349	
	Within Groups	7048.614	235	29.994		.261

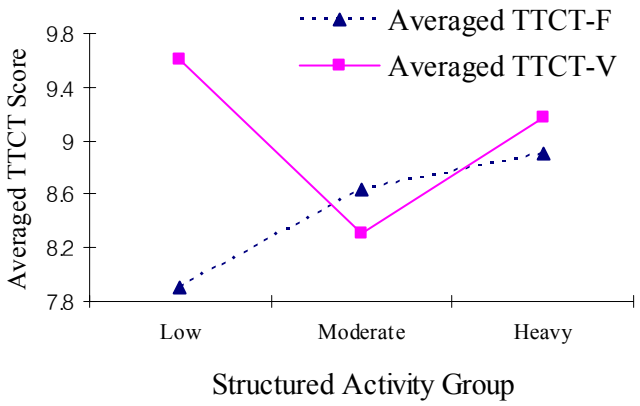

Figure 3. Structured activity group difference on the averaged TTCT-F and TTCT-V.

Time Spent on Free Play and Creativity

Children calculated their free time as playing with other friends outside or alone or reading by themselves or just relaxing but not including time spent on computer games and watching TV. Their mean free time a week was about 13.54 hours. There was no grade or location or parental SES difference on time spent on free time. But there was a gender difference significantly on time spent on free time ($t = 2.631$, $df = 223$, $p = .009$). Males tend to have more time for free play. Table 13 shows the correlations among time spent on computer games, TV, free play and after school education. The more time students have for free play, the more time they tend to spend on computer games or watching TV, but less time on structured activities. The students who spend more time on structured activities tend to spend more time on TV but not on computer games or free play. Mulitvariate tests between free play and the TTCT were not significant (Wilk's Lambda = .010, $F = .976$, $df = 756, 782.810$, $p = .632$).

Table 13

Correlation among Time Spent on Computer Games, TV, Free Play, and Structured Activities

	Computer games	TV	Free play	Structured activities
Computer game	-	.177**	.207**	-.058
TV		-	.254**	.173**
Free play			-	-.012
Structured activities				-

** Correlation is significant at .01level (2-tailed)

Time Spent on TV and Creativity

The median time of children's watching TV a day was 2 hours in this study (see Table 10). Student spent more time on TV rather than other activities (e.g., computer games, free play or structured activities). Students were divided into three groups: low TV group (spent less than 7 hours a week, n = 73), moderate TV group (spent 7 to 21 hours a week on TV, n = 87), and heavy TV group (more than 21 hours a week on TV, n = 73). Table 14 shows the significant differences of location, grade, parental SES , structured activities and computer game on time spent on TV ; location (t = - 4.998, df = 231, p < .001); grade (t = - 3.956, df = 231, p <.001); parental SES (F = 3.208, df = 4, 167, p = .014); after school education (F = 4.791, df = 2, 232, p = .009), computer game groups (F = 6.552, df = 2, 232, p = .002).

Rural children spend more time significantly watching TV than urban children. Sixth graders spend significantly more time watching TV than the third graders. There was also a significant difference between parental SES groups and TV time. The students with higher parental SES tend to spend less time on TV, and the students with lower parental SES, more time on TV. The more time the students spend on structured activities, the more time they tend to watch TV. The heavy structured activity group spends more time on TV than other groups significantly. Sixth graders spend significantly more time on structured activities (see Table 9) and they tend to spend more time on TV, The correlation between structured activity group and time spending on TV was .173 (p < .01). There was not much difference between low and moderate computer groups on TV. The heavy computer game group tends to spend more time on TV than others. The moderate game group spent more time on TV than the low group.

There was no significant gender difference with watching TV. This result is not the same as van Schie and Wiegman's (1997) study, which found that females spent significantly more time on TV.

Table 14

Effects of Location, Grade, Parental SES, Structured Activities, Computer Games, and Gender Difference on Time Spent on TV

	F	*t*	*df*	*p*
Location		-4.998	231	.000
Grade		-3.956	231	.000
Gender		-.059	231	.953
Parental SES	3.208		4, 167	.014
Structured Activity	4.791		2, 232	.009
Computer Game	6.552		2, 232	.002

There seems to be a contradiction here. Normally, we would expect that the higher parental SES group may tend to spend more time on structured activities, but less time on TV and computer games because parents may tend to pay more attention to how their children spend their time. But here heavy structured activity group tended to spend more time on TV than the others. The researcher has no explanation for the contradiction unless the time required to engage in computer games is more demanding than just watching TV, or parents try to control their children's time spent on computer games but not on TV because parents' attitude or concern about effect of computer games and TV may be different. Further research about Parents' attitude about computer games, TV, free play and structured activity will be needed.

A MANOVA on the TTCT scores for three TV groups showed significance (Wilk's Lambda = .895, $F = 1.833$, $df = 14, 448$, $p = .032$). One Figural Fluency univariate test was significant ($F = 3.891$, $df = 2, 230$, $p = .022$). Low TV group has the highest score but the moderate group has the lowest score on Figural Fluency. Even though there was not a significant difference between the heavy and the low TV group on F-Fluency ($t = -1.752$, $df = 230$, $p = .081$), but there was a significant difference between the low and the moderate TV group ($t = 2.731$, $df = 230$, $p = .007$). Table 15 shows that all Figural TTCT scales and Verbal Fluency and Flexibility scales contributed to discriminate TV groups more. The low, the moderate and the heavy TV groups' centroids on this discriminant function were (.366, .129), (-.309, .127) and (.002, -.281). The Low TV group has the higher positive scores on two discriminant functions.

Table 15

Structure Coefficients of Two Disriminant Functions

	Figural Fluency	Verbal Flexibility	Figural Originality	Verbal Fluency	Figural Flexibility	Figural Elaboration	Verbal Originality
F1	. 643(*)	-. 534(*)	. 488(*)	-.407(*)	. 406*	. 207	-. 336
F2	-. 192	. 105	-. 220	. 309	-. 145	. 538 (*)	. 470(*)

* Largest absolute correlation between each variable and any discriminant function

Research Question 2

Are there any interaction effects among the kinds of structured after school activities, genres of computer games, gender, grade, school achievement, school location and parental SES to creativity scores?

Structured Activities

One hundred and fifty nine students (67%) wrote down they had structured activities in English or math, 125(53%) in Korean, 97(41%) in science, 83(34%) in music, 82(34%) in Chinese, 75(32%) in athletics, 62(26%) in computer, 54(23%) in art, and 48(20%) in others. Thirty eight students (16%) reported that they have no structured activities [urban = 13(10%), rural = 25(23%)]. Figure 4 shows the mean time of each structured activities. This study found that more students spent more time on English in their structured activity after school. About one third of the students in this study took music or athletics classes privately. But the average time spent on those activities was next to the time spent on English. Simple regression between time spent on each structured activity and the Figural and the Verbal TTCT scales shows that the regressions were significant between structured activities and the Figural TTCT scores, but not with the Verbal TTCT (see Table 16). Table 17 shows the regressions between structured activities and Figural Fluency, Figural Flexibility, and Figural Elaboration. For Figural Fluency, English and music seem to be very good predictors; for Figural Flexibility, English, music and art; and for Figural Elaboration, music and computers seem to be.

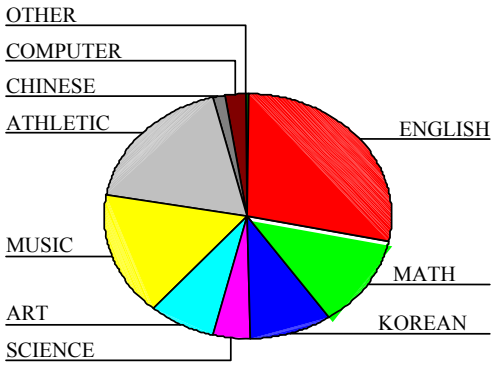

Figure 4. Distribution of time spent on each structured activity.

Table 16

Regressions of the TTCT Scales on Ten Structured Activities

	d f	*F*	*Sig*
Figural Fluency	10,22	2.181	.061
Figural Flexibility	10,22	3.643	.005
Figural Originality	10,22	1.370	.257
Figural Elaboration	10,22	2.270	.052
Verbal Fluency	10,22	.699	.715
Verbal Flexibility	10,22	.764	.661
Verbal Originality	10,22	1.157	.368

Table 17

Regressions for Ten Structured Activities Predicting the TTCT Scales

	Figural Fluency			Figural Flexibility			Figural Elaboration		
	B	SE B	β	B	SE B	β	B	SE B	B
English	.009	.003	.487**	.006	.002	.428**	.017	.028	.099
math	.000	.006	-.003	.000	.004	.016	-.051	.054	-.189
Korean	-003	.008	-.089	-.004	.005	-.120	-.055	.066	-.165
science	.000	.011	.008	-.002	.007	-.048	.023	.092	.053
art	.010	.006	.314	.009	.004	.336*	.095	.049	.331
music	-007	.003	-388*	-.006	.002	-.415**	-.084	.028	-.504**
athletics	.001	.003	.030	.003	.002	.218	-.005	.023	-.033
Chinese	.021	.045	.103	.036	.030	.227	-.058	.382	-.032
computer	.023	.015	.279	.023	.010	.359*	-.408	.126	.560**
others	-037	.066	-.087	-.037	.044	-.113	.165	.566	.045

* p<.05, ** p <.01

Parental SES

Table 18 shows the comparison of parental SES between urban and rural students. There was a significant different distribution in parent's education level between rural and urban schools (t = -8. 219, df = 170, p < .001). The average of the fathers' education level at the urban school was the college degree, compared with the high school diploma at the rural school.

Because parental SES was significant for location, a Manova was run to test whether there was a location difference on the TTCT scales. The MANOVA was significant (Wilk's Lambda = .887, F = 4.179, df = 7, 230, p < .001). Urban students had significant higher scores on Figural Originality (t = 2.767, df = 236, p = .006) and on Figural Elaboration (t = 2.802, df = 236, p = .006). A discriminant function was

significant (Wilk's Lambda = .887, χ^2=27.834, df = 7, p < .001). Figural Elaboration and Figural Originality contributed more to this function (see Table 19). Figural Elaboration and Figural Originality are the variables one would expect to distinguish group membership.

Table 18

Frequencies for Rural and Urban with Parental SES

	Elementary	Middle school	High school	B.A.	M.A ./ Ph.D.
Urban	1	1	15	91	25
Rural	4	4	21	9	1
Total	5	5	36	100	26

Table 19

Structure Matrix for Discriminant Analysis of the TTCT Scales Predicting Location

	Function 1
Figural Elaboration	.511
Figural Originality	.505
Verbal Flexibility	-.172
Figural Fluency	.131
Verbal Originality	.115
Figural Flexibility	-.087
Verbal Fluency	-.007

No significance was found for students' time spent on computer games or free play by parental SES except for TV (F = 3.208, df = 4, 163, p =.014), subject of Korean

($F = 2.672$, $df = 4, 166$, $p = .034$) and structured activities ($F = 2.514$, $df = 4, 167$, $p = .044$) (see Table 20). Figure 5 shows that the students with low parental SES spent more time on TV and less time on structured activities than the students with high parental SES.

Table 20

ANOVA for Effect of Parent SES on Time Spent on Computer Games, TV, Free Play, Structured Activities, and Students' Achievement Scores

	df	*F*	*Sig*
Computer Games	4, 167	.656	.644
TV	4, 167	3.208	.014
Structured Activities	4 ,167	2.514	.044
Free play	4, 159	.307	.873
Korean	4, 166	2.672	.034
Math	4, 167	1.502	.204

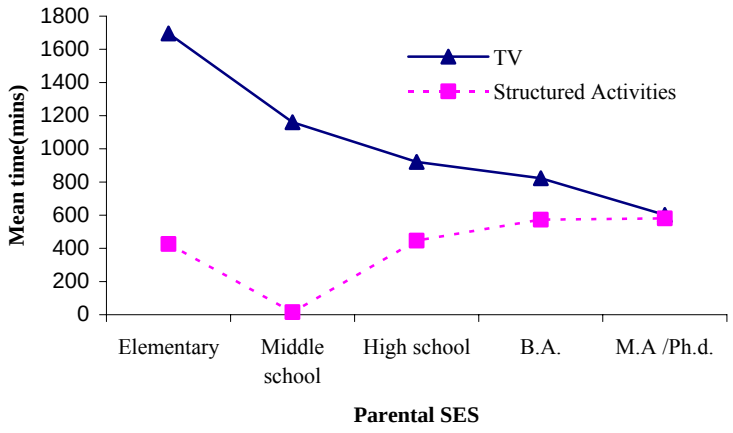

Figure 5. Comparison on time spent on TV and structured activities by parental SES.

Figure 6 shows the significant interaction between parental SES and TV groups on the averaged Figural TTCT scores (F= 2.911, df = 4, 158, p = .023). The averaged TTCT-F scores of SES 1 (father's education as elementary school level) and SES 4 were not changed by time spent on TV. But the groups, SES 2 (father's education as middle school level) and SES 5 (father's education as master level or above), were getting lower scores of the Averaged TTCT-F, when they spent more time on TV. Interestingly, SES 3 (high school level) got higher scores of the Averaged TTCT-F if they spent more time on TV. The higher the student's parental SES is, the higher the achievement score of Korean the students have. There is a significant difference on the achievement score in Korean by parental SES (F = 2. 674, df = 4, 167, p = .034) but not in math (F = 1.502, df = 4, 167, p = .204). Multivariate tests between Parental SES on the TTCT-F and the TTCT-V revealed significance (Wilk's Lambda=.721, F = 1.977, df = 28, 581.916, p = .002). One univariate test for Figural Originality was significant (F = 4.221, df = 4,167, p = .003), but not for the other TTCT scales (see Table 21).

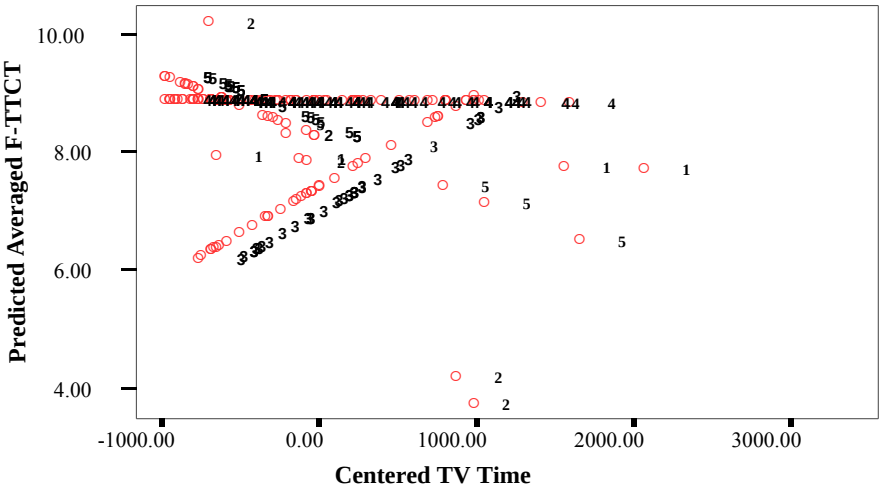

Figure 6. Interaction between parental SES and TV on the averaged TTCT-F.

Table 21

Univariate ANOVA Tests of Parental SES on the TTCT Scales

	df	*F*	*Sig*
F-Fluency	1, 493	1.493	.207
F-Flexibility	4, 167	1.578	.182
F-Originality	4,167	4.221	.003
F-Elaboration	4,167	1.018	.400
V-Fluency	4,167	.401	.807
V-Flexibility	4,167	.577	.680
V-Originality	4,167	.570	.685

The contrast of students' scores between the groups with B.A. and M.A. or Ph.D. and the groups with High school, Middle school and Elementary on Figural Originality was significant (t = -2.455, df = 167, p = .015). The score of students with parents who have a B.A. or higher education was higher for Figural Originality than those with a High School diploma or less parental SES. If the averaged Figural and Verbal TTCT scores and Figural Elaboration were used to simplify, there was a significant difference between parental SES groups on the averaged Figural TTCT (F = 2.919, df = 4, 167, p = .023), but not on the average Verbal TTCT (F = .435, df = 4, 167, p = .783) nor Figural Elaboration (F = 1.018, df = 4, 167, p = .400). The higher the student's parental SES is, the higher the score of the averaged Figural TTCT scales the students have (see Figure 7).

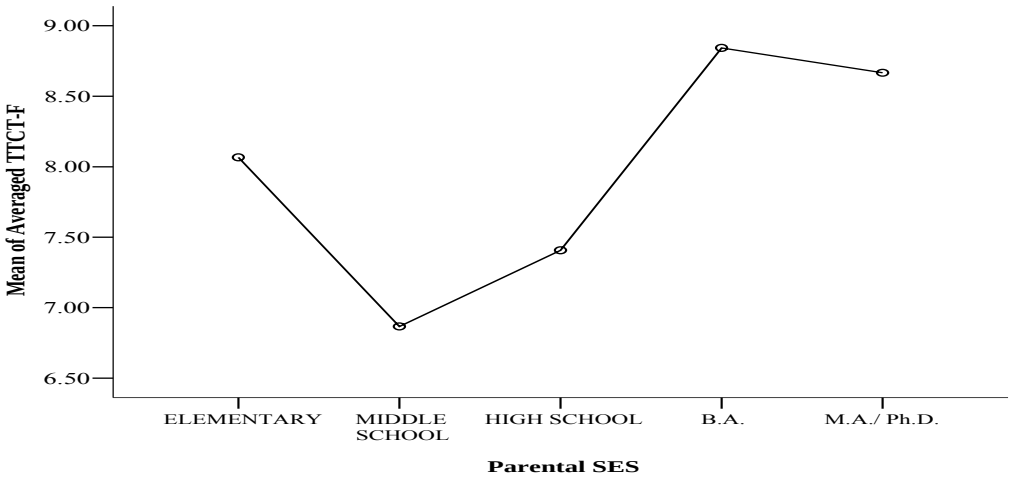

Figure 7. Parental SES and related group mean scores of the averaged TTCT-F.

Because the MANOVA was significant between Parental SES on the TTCT-F and the TTCT-V, discriminant analysis was conducted to assess how each scale of the TTCT-F and the TTCT-V discriminated the five parental SES groups. Box's test of equality of covariance matrices was significant ($F = 2.854$, $df1 = 56$, $df2 = 17907.97$, $p < .001$), so that the assumption of equality of covariances between groups was not tenable. Table 22 shows two discriminant functions were significant among the TTCT scales. Figural Flexibility appears to have greater contribution to the first function and Figural Originality, Figural Fluency, and Verbal Originality do to the second function (see Table 23). Table 24 shows that the students with elementary to high school diploma parents have a negative centroid at function 1 but the other parental SES groups have positive ones. At function 2, the centroids of elementary and high school diploma group were negative and the other groups' were positive.

Table 22

Significant Discriminate Functions

Test of Function(s)	Wilks' Lambda	Chi-square	*d f*	*Sig*
1 through 4	.721	54.069	28	.002
2 through 4	.839	29.051	18	.048
3 through 4	.928	12.267	10	.268
4	.976	4.028	4	.402

Table 23

Structure Matrix to Show the Contribution to the Discriminant Functions

	Function			
	1	2	3	4
F-Flexibility	.451(*)	.185	-.025	-.184
F-Originality	.499	.733(*)	-.153	.257
F-Fluency	.024	.571(*)	.118	.050
V-Originality	.221	.224(*)	-.073	-.028
V-Flexibility	.112	.082	-.464(*)	.012
V-Fluency	.169	.066	-.257(*)	.209
F-Elaboration	.263	.039	.406	.423(*)

* Largest absolute correlation between each variable and any discriminant function

Table 24

Parental SES Groups' Centroids at the Discriminant Functions

	Function1	Function 2
Elementary	-.315	-.224
Middle school	-2.212	.448
High school	-.095	-.601
B.A.	.122	.186
M.A. or Ph.D.	.147	.072

Multivariate tests of the interaction between centered time spent on computer games and parental SES on the TTCT scales were run. The multivariate tests of interaction was not significant (Wilk's Lambda = .793, F = 1.339, df = 28, 563.888, p = .116). The difference by parental SES on the TTCT scales was consistent in whatever computer group students belong to such as heavy, moderate or low.

Nine Groups' Contrast

The negative correlation between structured activities and computer games, and the significant cubic comparison among the parental SES groups on structured activities were mentioned earlier (see Table 13 & Figure 5). To figure out the interaction effect between computer games and structured activities on the TTCT scores, groups were divided into 9 groups by 3 (heavy, moderate, and low) computer game groups x 3 (heavy, moderate, and low) structured activity groups. Table 25 shows that one univariate test for Figural Flexibility was significant in this 9 groups (F =2.368, df = 8, 229, p = .018). Planned contrasts were run to compare the 9 groups, i.e., how computer time and after school level are affecting on the averaged Figural TTCT. Averaged Figural and Verbal TTCT scores were used to set a higher Bonferroni error correction. Bonferroni error correction per contrast was set at .017. Three contrasts were run; Contrast 1 (C1) between moderate and heavy computer game groups; Contrast 2 (C2) between the moderate and the heavy computer game groups among the low structured activity groups; Contrast 3 (C3) between the moderate and the heavy computer game groups among the heavy structured activity groups. There were significant differences in the contrast between the moderate and the heavy game groups among the low structured activity groups for the averaged Figural TTCT scale (t = -2.746, df = 20.127, p = .012)

(see Table 26). Table 26 shows that the contrast between the moderate and the heavy computer groups among the low structured activity groups was significant in the averaged Figural TTCT scales, even though the contrast between the moderate and the heavy computer groups among the heavy structured activity groups was not significant. The students in the low structured activity groups earned the higher scores for the averaged Figural TTCT scales, when they belong to the heavy computer group. There was no difference among the heavy structured activity groups whether the students belonged to the heavy or the moderate computer group. Figure 8 shows that whether students engage in heavy, moderate or low computer game use, students with high structured activities had higher scores. But for the low structured activity groups, the heavy computer game use group had the highest scores.

Table 25

ANOVA Tests among Nine Computer Games by Structured Activity Groups on the TTCT

	d f	*F*	*Sig*
Figural Fluency	8, 229	1.326	.231
Figural Flexibility	8, 229	2.368	.018
Figural Originality	8, 229	1.491	.161
Figural Elaboration	8, 229	.238	.983
Verbal Fluency	8, 229	1.477	.167
Verbal Flexibility	8, 229	1.476	.167
Verbal Originality	8, 229	1.612	.122

Table 26

Contrasts among Nine Groups on the Averaged F-TTCT

	Contrast	*t*	*d f*	*Sig*
Averaged F-TTCT*	C1	-2.574	14.433	.022
	C2	-2.746	20.127	.012
	C3	-1.094	5.805	.316

**Levene's F Statistic significant at p< .05*

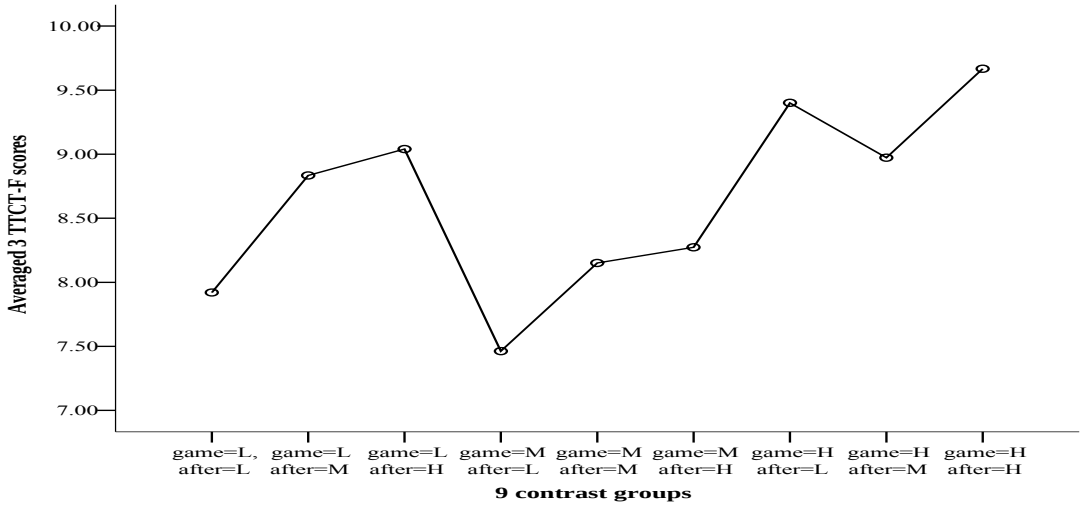

Figure 8. Nine groups' contrast on the averaged Figural TTCT scores except Figural Elaboration scale.

Genres of Computer Games and Creativity

To know whether specific genres of computer games are related differently with children's creativity, the researcher included some questions in the survey questionnaire to ask the students to write down their favorite games. The researcher coded their games as action, RPG or MMORPG, strategy, simulation, education, board and mixed (students usually wrote many kinds of computer games rather than one kind). Table 27 shows the

distribution of favorite games of the students in this study. Thirty two percent of the students in this study who replied listed their favorite type as action games, 30% reported many different genres of games, 14% RPG or MMORPG, 6% simulation, 3% strategy and 2% for board or educational game. Interestingly, no children in this study chose adventure games as their favorite.

Table 27

Children's Reported Use Distribution of Favorite Computer Games

	Frequency	%
ACTION GAMES	74	31.1
RPG OR MMORPG	33	13.9
STRATEGY GAMES	6	2.5
SIMULATIONS	13	5.5
MIXED GAME	70	29.4
EDUCATIONAL	1	.4
BOARD GAME	3	1.3
NO ANSWERE	38	16.0
TOTAL	238	100.0

Only one child answered that she played an educational game developed for English. About 56% of the answered students said that they enjoyed casual games. This result is similar with the recent trend to casual games from MMORPG in Korea (Hursthouse, 2005). The Korean children in this study may show a pattern of today's Korean children's computer play. They prefer online casual games which don't require long involvement to get the aimed higher level for many days (GDITISS, 2004, p. 43). Casual games don't require a long time to involve the game, to get satisfaction and provide children to play with others on line together. In this study, 32 % of the students

answered the reason for playing computer games was playing with other students on line (29% for fun, 17% to gain new knowledge, 7% because of with whom no friend to play, 7% for solving stress and using break time after structured activities, and 5% provided no reply). This result is opposite with Joosssen's study which "showed most children prefer to play video games alone" (as cited in van Schie & Wiegman, 1997, p. 1181). Children play computer games to play with friends on line in this study.

Table 28

Gender Differences on the Preference for Genres of Computer Games

	Action	RPG/MMORPG	Strategy	Simulation	Mixed	Education	Board
M	39	24	6	1	46	0	1
F	35	9	0	12	24	1	2
%	37	16.5	3	6.5	35	.5	1.5

There was a gender difference for preference in a genre of computer games (χ^2 = 25.548, df = 6, p <.001). Twenty four boys in this study preferred RPG but only 9 girls answered. Six boys chose strategy as their favorite game but no girl chose. Twelve girls chose simulation games as their favorite but only one boy chose (see Table 28). There was no significant difference between locations (χ^2 = 6.976, df = 6, p = .323), grades (χ^2 = 5.209, df = 6, p = .517), parental SES groups (χ^2 = 28.179, df = 20, p =.105), structured activities (χ^2 = 8.549, df = 12, p =.741) and computer game groups (χ^2 = 13.984, df = 12, p = .302) to select the genres of game as their favorite. Urban children

in this study use more diverse platforms of computer games than rural children. Interestingly, urban children use handheld devices more than video games (see Table 29). No rural child reported on their using mobile games, but some urban children said that they play mobile games, using their parents' cell phones or even their own cell phones. There were no significant gender differences on the all TTCT scales (Wilk's Lambda = .960, F = 1.354, d f = 7, 230, p =. 226).

Table 29

Urban-Rural Differences on the Proportion of the Use of Platforms

	Computer CD	Internet	Video	Handheld	Arcade
Urban	32.3 (%)	41.6 (%)	8.0 (%)	10.7(%)	7.4(%)
Rural	20.1 (%)	63.6 (%)	6.9 (%)	3.7 (%)	5.7(%)

The MANOVA between favorite genres of computer games on the TTCT scores was significant (Wilk's lambda = .711, F = 1.578, df = 42, 880.560, p = .012). Discriminant analysis was run to assess how the TTCT scales would discriminate genres of computer games. Box's M test, which tests for equal population covariance, was significant (F = 1.871, $df\ 1$ = 84, $df\ 2$ = 7053.343, p < .001). Only one discriminant function was significant (Wilk's Lambda = .711, χ^2 = 65.364, df = 42, p = .012). Table 30 shows that Figural Originality contributed more than other scales on this function to separate genres of computer games.

Table 30

Structure Matrix of Discriminant Analysis for Genres of Computer Games

	1	2	3	4	5	6
F-Originality	.813*	.278	.356	.184	.044	.244
F-Flexibility	.195	.307	.736*	.276	.008	-.076
F-Elaboration	.222	-.523	.281	.702*	.185	.219
V-Flexibility	.014	.560	.070	.563*	.248	.148
F-Fluency	.427	.218	.389	.269	.506*	-.123
V-Fluency	-.044	.474	-.011	.491	.313	.513*
V-Originality	.012	.346	.171	.287	.419	.501*

Group centroids on this function were as follows: Action (-.308); RPG / MMORPG (-.317); Strategy (-.582); Simulation (.213); Mixed (.504); Education (-1.077); and Board (-1.067). Based on these centroids, the genre of computer game group was recoded for contrast; Action, RPG/ MMORPG, and Strategy: Simulation, and Mixed; Education and Board. The multivariate test with these new groups on the TTCT scales was significant (Wilk's Lambda = .825, $F = 1.797$, $df = 21, 546.128$, $p = .016$). The most significant difference was between Education/ Board and the other groups. But since the students who chose Education or Board games were small in numbers, the researcher tried to compare the other groups without Education and Board games (i.e., Action, RPG or MMORPG, Strategy, Simulation, and Mixed). Multivariate tests between these 6 groups on the TTCT scales were significant (Wilk's Lambda = .758, $F = 1.910$, $df = 28, 668.449$, $p = .003$). Except the Figural Elaboration, the strategy group had the lowest score in all the TTCT scales. One univariate test between genre groups on Figural Originality was significant ($F = 5.658$, $df = 4, 191$, $p < .001$). This result is

similar with the discriminant analysis held before (see Table 29). There was no interaction between time spent on computer games and genres of computer games on the TTCT scores (Wilk's Lambda = .834, F = .961, df = 35, 763.823, p = .535).

To design a path-model to explain the relationship between genres of computer games and creativity, simple regressions between genres of computer games and 7 TTCT scales were made. The regression was significant only on the scale of Figural Originality (F = 3.957, df = 6, 193, p = .001, R^2 = .110) among the seven TTCT scales. Figure 9 shows how different kinds of computer games were correlated to Figural Originality. Action game was deleted because of its multicolliniality (Tolerance < .001)

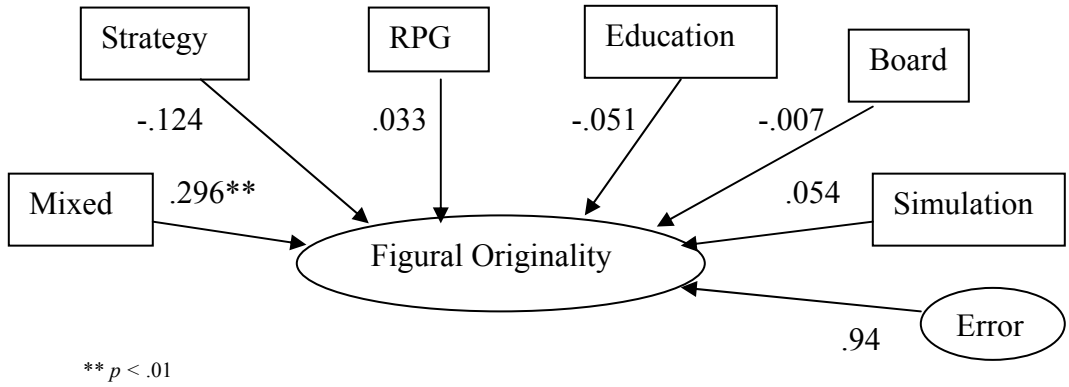

Figure 9. Structural path diagram for genres of computer games on Figural Originality score of the TTCT.

In Figural Originality, the mixed group was a high predictor. Strategy group was next even though the regression coefficient was not significant (p = .058). There might be different genre effects on the Figural Originality but it is hard to say which exact game in mixed genres influence the TTCT scales differently. The researcher is not sure

this is because of different effect by genres of computer games or because of large number in the mixed group. Further study about the effects of different genres of games on creativity needs to be researched (see Figure 10).

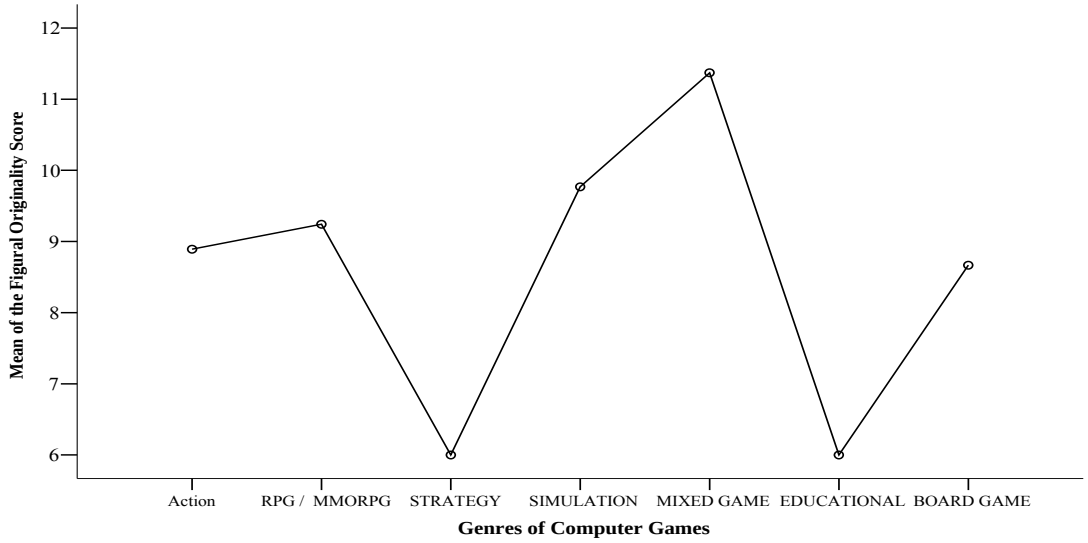

Figure 10. Plot of mean scores of Figural Originality among preferences of genre of computer games.

Computer Games and School Achievements

To find out the relationship of the computer games and school achievement, univariate tests between scores of Korean and math, and computer game groups were conducted. There were no significant difference between time spent on computer games and achievement scores of both subjects, Korean (F =2.051, df = 2, 234, p =.131) and math (F = .055, df = 2, 235, p =.947). This result is opposite of the stereotype that heavy computer students are low achievers. The contrast between heavy and low computer groups was not significant on both two achievement scores; Korean (t = 1.817, df = 234,

p = .071); math (t = .084, df = 235, p =.933). But there is a significant difference between parental SES and the achievement score of Korean (F = 2.672, df = 4, 166, p = .034), though there is no significance found with math (F = 1.502, df = 4, 167, p = .204). The contrast between low parental SES group with elementary, middle and high school diploma and high group with B.A. and above was significant for the subject, Korean (t = -3.133, df = 166, p =.002) (α = .0125). Parental SES is a very influential factor for students' achievement scores in Korean as well as students' Figural TTCT scores.

Path Model

Using AMOS, a path-model was made to describe some possible causal relationship among children's play (TV, free play and computer games) and parental background (after school private education activities and parental SES) with the TTCT scales. Though parental SES is not an interval variable, it was assumed to be an interval in this path-model.

Path Model 1 (see Figure 11) met the minimum requirement (χ^2 = 126.7, df = 48, p<.001, CFI = .945, RMSEA = .083, N = 238). Even though RMSEA was higher than .05 and parental SES was an ordinal, but assumed to be an interval in this model, this path-model shows how children spending time on computer games, TV, structured activities and parental SES is correlated with the TTCT scales. Parental SES and students' structured activities were not made by the students, but by their parents. But these two variables are correlated with figural creativity more than verbal creativity. The correlation between parental background and verbal creativity was negative. The higher parental SES is, the more time students tend to spend on structured activities after school.

These activities may ask students to hear or be passive to understand or memorize without discussion. Higher SES parents may often take their children to museums or amusement parks but lower SES parents may not. During the interview, rural students mentioned "once or twice a year" when the researcher asked how often their parents took them for picnic or museum exhibitions, etc, compared with urban students being taken once or twice a month. Spending time on computer games, TV, or free play loaded more positively on Verbal TTCT scales than the parental factor. Possibly the parental factor might suppress the Verbal TTCT scales or that children's play factor positively might increase the Verbal TTCT scales is not known.

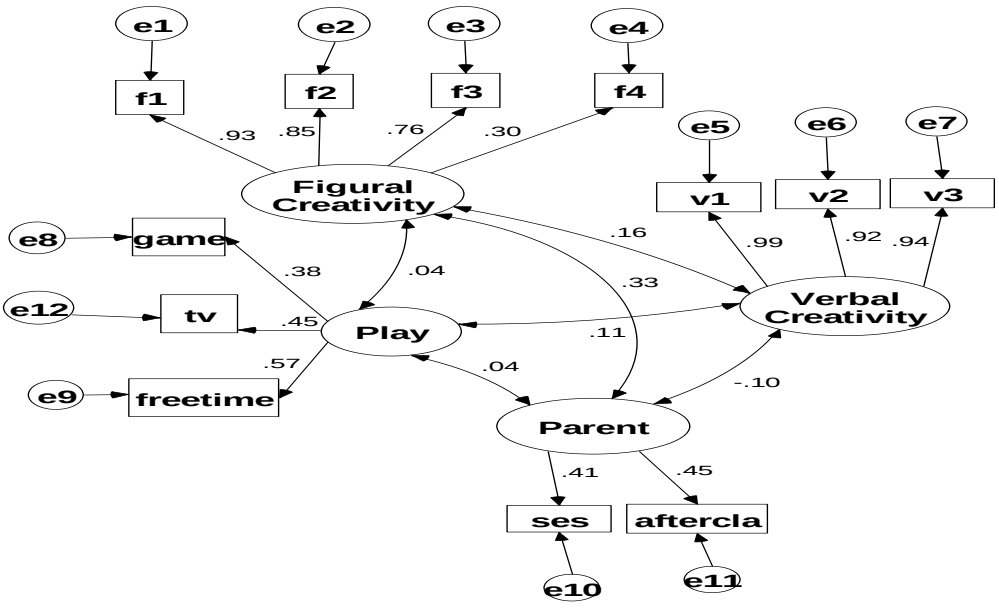

Figure 11. Path Model 1: Four latent variable covariance model (*Chi*-square = 126.7, *df* = 48, $p < .001$, CFI = .94, REMSEA = .083, *N* = 238).

To see how each computer game, structured activities, free play, TV, parental SES and the TTCT scales is correlated, another path model was made (Figure 12) without putting together under latent valuables (i.e., parental factor and play factor). Path model 2 met the minimum requirement ($\chi^2 = 95.976$, $df = 38$, $p < .001$, CFI = .960, RMSEA = .080, $N = 238$). Path model 2 shows that each parental SES and structured activities are correlated with figural creativity positively but negatively with verbal creativity. Game is correlated with figural creativity and verbal creativity positively but the correlation coefficient was small. TV and free time are more correlated with verbal creativity rather than figural creativity interestingly even though the coefficients were too small. The weighted regression coefficient of free time (.08) to verbal creativity was larger than other variables. This path model shows the same result of this study and path model 1.

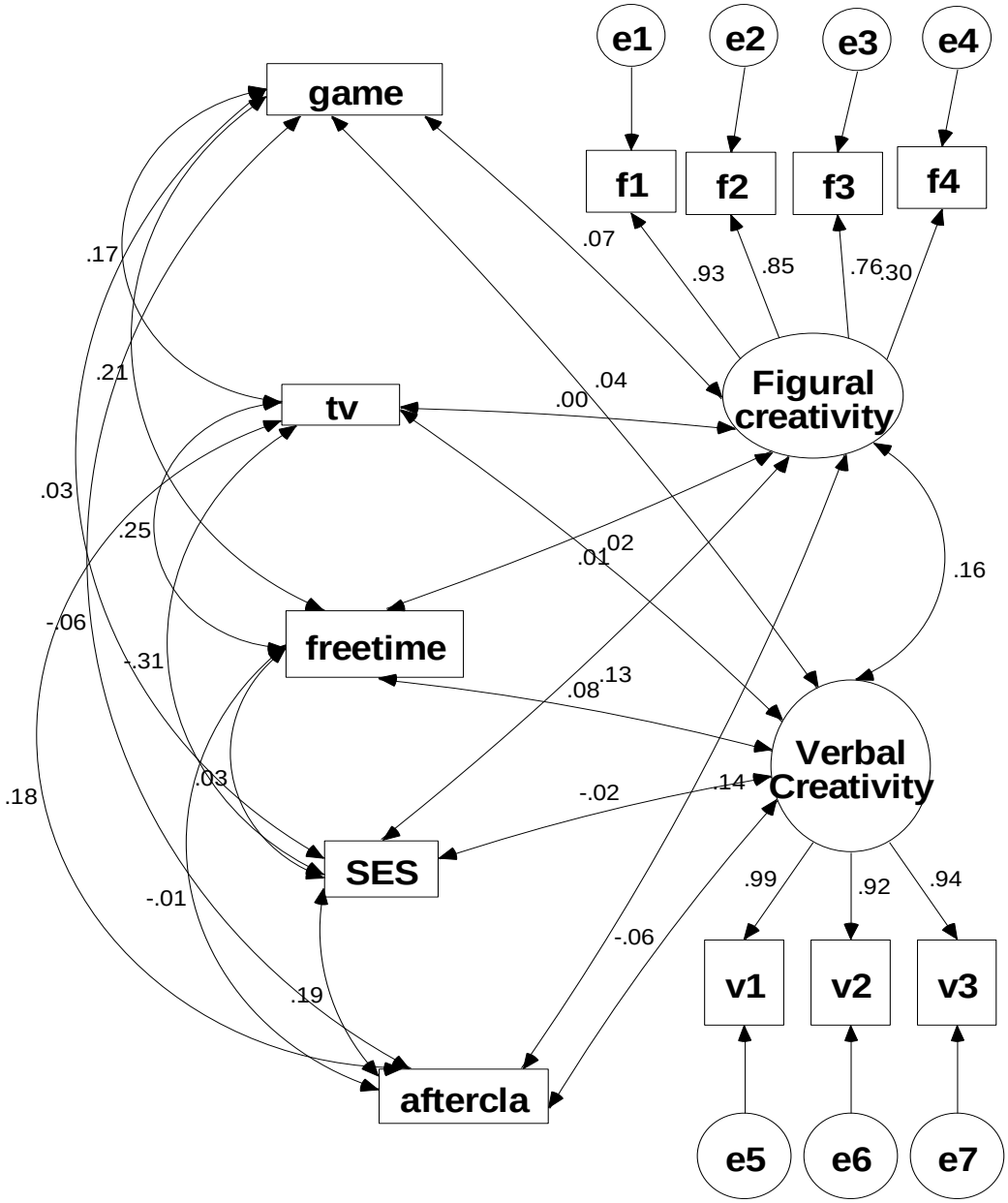

Figure 12. Path Model 2: Two TTCT factors covariance with five manifest student measures (Chi-square = 95.98, $df = 38$, $p < .001$, CFI =.96, REMSEA = .08, $N = 238$).

Qualitative Data: Structured Interviews with Selected Subjects

Students from the Low Computer Game and Low Structured Activity Group

Minkyung (6th grade at the rural school, female)

Minkyung doesn't like computer games because they are not fun, even though her house is connected to the internet. She spends her leisure time reading novels or nonfiction books. She had taken piano classes after school until the 3rd grade and a computer class between grades of 4-5. However, she doesn't have any structured activities at present. Her village has only 5-6 houses, and is about a 20 minutes walk to another small village. She can't find her age group in her village and has some time to play with her friends from other villages during weekends. She doesn't like the fact that some male students learn bad slang through computer games and use it in real conversations. She thinks that computer games may have a negative effect on studying because she doesn't want to study when she is succeeding during a computer game. She tends to produce winning strategies during computer game play.

Minsoo (3rd grade at the urban school, male)

Minsoo prefers talking, playing outside or hanging out with his friends to playing computer games. He doesn't establish time for computer games so that he doesn't play regularly and prefers non violent computer games. He thinks that computer games help some people make friends because computer games provide a context for chatting and talking with others without seeing them in person. He mentioned that his sister is really fat, but through computer games, she doesn't need to be saddened by her obesity to make friends. He said that he usually goes to bed at midnight. After dinner, he studies

English, math, and Korean writing by himself at home. Even though he doesn't have many structured activities after school, he complains about his lack of time to play.

Students from the Low Computer Game and Moderate Structured Activity Group

Eunhee (3rd grade at the urban school, female)

Eunhee likes to play computer games but her older sister usually occupies the home computer so that she can't find more than 1 hour a day to play computer games. Her parents prohibit their children from playing computer games on weekdays. They try to control her and her sister's time playing computer games, even though they always find it is difficult. She thinks that computer games have both positive and negative aspects to affect people. She mentions her 7th grade sister as an example. Through computer games, her sister could make a boy sitting next to her in the classes her close friend. Computer games may help to make lots of friends. However, she says computer games seem to make her sister have a bad temper, an aggressive and violent attitude toward her parents. She thinks computer games addict people to contents of computer games and seem to prevent people from thinking creatively. Even though she likes to play computer games, particularly when she sees her sister play, she prefers playing with her friends outside to computer games.

Juhee (3rd grade at the rural school, female)

Juhee's parents spend their time together playing computer games and watching TV. She spends her free time drawing or reading. Her middle school brother spends more time on computer games, so that she complains that he often asks her to bring a cup of water during his playing time. Her brother always draws only one character of computer games, 'Jolla Man', which seems like a stick man. She says that sometimes he

shows very aggressive action verbally and physically when he is angry. Her brother blinks his eyes frequently during computer games because of dry eyes. She thinks that computer games produce addiction and people spend their time alone so that they can't make friends. Based on her observation of her brother, she thinks that computer games are not good, but she really wants to play computer games whenever she finds her brother playing.

Students from the Low Computer Game and High Structured Activity Group

Cholmin (*6th grade at the urban school, male*)

Cholmin moved to Seoul one year ago from a small southern city. His parents decided on the move to provide a better educational environment; in Seoul parents are involved and get interested more in their children's education with more money and time, and there are more opportunities to obtain diverse private structured activity programs. Cholmin doesn't have much time to play computer games because he has many structured after school activities. But he sometimes plays computer games, because he hasn't made new friends yet and is still alone. He thinks that children who don't have many friends and have an introverted personality tend to play computer games. His parents control his general time for playing computer games, but he often controls his playing time. He thinks that computer games make children more aggressive and segregate them as heavy gamers and non-gamers. He thinks certain computer games such as puzzle ones may increase creativity. Depending on genres of computer games, creativity can be increased or not.

Youngen (*6th grade at the urban school, female*)

Youngen has many structured after school activities. She has some classes every day except Sunday. She is busy doing her homework for her structured classes. She finds only 30 minutes everyday to play computer games. She plays jackstones with her friends and has a habit of making imaginative stories before going to bed. She said that she had more than 10 close friends and is popular at the class. Once a month, her family goes outside together to visit museums, and parks, etc. She thinks computer games don't have any relationship with creativity or school achievement. But heavy computer gamers seem to have restricted topics related only with computer games when they talk with others. She thinks computer games make children addicted to games and play alone so that they are not good for social development. She mentioned that her school and family put the priority on learning achievement rather than on creativity.

Students from the Moderate Computer Game and Low Structured Activity Group

Dahoon (*6th grade at the rural school, male*)

Earlier, Dahoon took a computer course and another course that combined the teaching of Math, Korean, English, Science and Sociology. However he doesn't take any course at the research time. His computer at home can access the internet by a telephone modem. Before his parents bought a computer, he played handheld games. In his village, he has only one of his age group and younger children with whom to play. There is no small store near his house. He often goes by bike to the next village to buy some snacks.

His parents don't care whether he uses computers for learning or to play computer games, but care about how long he uses computers. He usually plays computer games because he can't find friends outside and some younger children near him visit

him and ask to play computer games. He said that computer games are a solution for his free time and his stress. When he is angry, he plays a certain game (such as the game to write certain name or choose a character and crashes that name or that character on the screen). He said that he can distinguish virtual violence and real violence, so that this kind of game doesn't create any confusion for him. He tends to play computer games when he gets stressed by his friends. Nowadays, his favorite game is 'cart rider'. He produces a winning strategy during computer games. He thinks that heavy computer gamers tend to have low grades at school. After computer games, he gets sensitive, derisive and aggressive toward others. He thinks computer games can disturb studying but TV may disturb more.

Dongyoung (6th grade at the rural school, male)

Dongyoung was raised in Seoul but moved to this rural area. He likes to live in this rural area, because rural students tend to be less aggressive, more open minded toward each other, and there is no bully. His village has only 3-4 families. Both his parents work at factories. They ask him to study first and then play computer games, but there is no restriction on playing computer games from them. He plays computer games until he gets bored. He plays computer games because he doesn't have anything else to do rather than to solve his stress. He makes an appointment to meet his friends at certain computer games, using their own ID's. He thinks computer games are helpful to play with other friends on line and improve word processing skills faster. He thinks that violence of computer games doesn't affect children and TV is more harmful and disturbs learning because people watch TV with an absent mind. He doesn't have much time to read.

Student from the Moderate Computer Game and Moderate Structured Activity Group

Mina (*3rd grade at the rural school, female*)

Mina has only piano class one hour a day after school. She likes to play with her friends outside after school. During weekends, she hangs out by herself at home. Both her parents come home around 8 p.m. from their jobs. Her mother usually takes a nap and her father goes out to another job during weekends. Her friends ask her to meet at virtual places like online games after school. She thinks heavy computer gamers tend to have low achievement at school. She usually plays computer games during vacations but now her computer is out of order.

Student from the Moderate Computer Game and High Structured Activity Group

Soonjong (3*rd grade at the rural school, male*)

Soonjong likes to read during his free time and play marbles with his friends outside. He moved from Chongju, which is bigger and more crowded than the place he lives now. His parents try to find some time to take him out or get together with him. Computer games make him feel better because of their stimulating and enthusiastic characteristics. He thinks that computer games help him make friends. He clearly said that computer games wouldn't interfere with making friends at a real setting like schools. Virtual violence of computer games is not related to real life.

Student from the Heavy Computer Game and Low Structured Activity Group

Yoonsoo (*3rd grade at the rural school, male*)

Yoonsoo doesn't have any structured activities. He usually doesn't go outside to play with other friends after school. He doesn't watch TV. He plays computer games only after school. Because he didn't read any books, his mother was enough angry to

burn all the books at his house. He said that he doesn't have any friends because he puts on airs. Like other rural students, not many children live near his house. Because he doesn't have any close friends and there are not many children near his house, he plays computer games. Computer games let him make friends and forget his loneliness or being bullied at school.

Students from the Heavy Computer Game and Moderate Structured Activity Group

Jaemin (*3rd grade at the rural school, male*)

Jaemin was very actively involved with this interview. He tried to say a great deal about himself. He is short for his age and is very cheerful. After his parents got divorced, he moved to this rural area to live with his grandmother. His father is working at the hospital as an office clerk. There are other two same age children near his village. During summer, his father used to take him and his brother out to fish.

After school, he doesn't play outside with other friends. He plays computer games for about five hours and thirty minutes a day during weekdays and 15 hours a day during weekends without eating lunch. There is no person to restrict his computer games. His father returns back from work at 9 p.m. and at that moment he usually stops computer games. During computer games, he is so concentrated on playing them and shows some anger when somebody bothers him or disturbs his computer games.

He thinks computer games make heavy gamers seclude from others because they don't have time to play with other children. He also mentioned that violence of computer games doesn't affect the real life. He likes to live in a small rural area because no children here bully him because of his parents' divorce and the number of student in a class is smaller so it is easier to make friends at the rural school than at the bigger school

in a city. He proudly said that even though he plays computer games a lot, his school achievements are high.

Eunmi (*3rd grade at the urban school, female*)

Eunmi's parents do not restrict her time on computer games. She has 3 structured private classes after school but that is not many compared to other students. She plays computer games one and a half hours a day and more during weekends. She does her homework, draws or plays games for her free time. She likes to read comic books but doesn't have much time to read novels or to day dream. Her parents rarely take her and her older sister to museums, etc. After finishing computer games, she feels better. Her 8th grade sister plays computer games between 10 pm and 4 am. Her sister doesn't have enough time to sleep. Her sister has weak sight and bloodshot eyes because of lack of sleep. She is concerned about her sister's sight. She thinks that computer games are helpful to make friends but not good if one plays alone with computer games. She thinks inline skating with friends outside is more fun than playing computer games.

Student from the Heavy Computer Game and High Structured Activity Group.

Hyunsoo (*6th grade at the urban school, male*)

Hyunsoo is the only one who belongs to the heavy computer game and heavy structured activity group among the interviewees. His parents check his time to play computer games. He takes structured classes for 2.7 hrs a day and plays computer games 3.5 hrs a day. He said he reads 15 books a week regularly, including those during his reading structured activity class.

He said that computer games give him enthusiasm, pleasure, and self-assurance after obtaining high scores and increasing levels of computer games. But he thinks that

computer games are not related with creativity and not much change happens before and after computer games. He said that computer games exist for fun or entertainment, not for other purposes. But he thinks that computer games make children segregate into heavy gamers and non gamer groups.

Findings

Rural students in this study play computer games as much as urban students do. This is contrary to what the researcher had assumed, i.e., that rural students probably have more free time to play outside with other friends and less time to spend on computer games, and structured activities. The children in rural school live in 3-4 family villages so that they can't find their age group to play with outside. On the questionnaire and during the interview, the rural students said that they don't have friends with whom to play after school because of their geographical isolation from others. Their parents tend not to restrict their time spent on computer games as the urban parents do.

Computer games provide rural students with a channel to meet their friends or make new friends in virtual settings after school. Children with less restriction from parents and less structured activities tend to play computer games more. Some children find computer games as the solution for their personal problems such as parents' divorce, being bullied by other students at school, lack of friends, physical weakness, etc.

The parents in urban schools tend to check their children's time so that almost all interviewee children at the urban school mentioned about their parents' involvement with their schooling, structured activities, and computer games. In another survey research on urban parent's attitude of computer games, parents were reported that they tried to control their children's computer game time (Kang, 2004). Rural parents in this

study work late at night and even during weekends, so that they give more freedom to their children. No rural child in this interview reported parental intervention about playing computer games.

The urban students have more time with their parents and tend to have and read more books. Some students move to urban schools because of better educational environments. Even though the statistical comparison of time spent on structured activities was not significant between two schools, urban interviewee students complained about their lack of free time and heavy structured activities. The researcher observed that two students put up a barrier so that the students next to them could not to see their answers during administration of the *Torrance Tests of Creative Thinking* at the urban school. Two students opened their art textbook for cheating during administration, even though the researcher mentioned about that these tests didn't affect their achievement scores. There might be more competition and students might be more sensitive to tests themselves at the urban school.

During the interview with heavy computer gamers, they didn't show any concerns about computer games. They said that they can distinguish between virtual aggression of computer games and real aggression. They only concern about heavy gamers involved those who show an addiction level to computer games based on interviewees' middle school brothers or sisters. Interviewed children mentioned physical effects of computer games (i.e., weak vision, aching arms and shoulders, etc.). They also express concern about short temper right after aggressive games. The length of exposure to and the degree concern of involvement with computer games may influence children's enjoyment, use of their capacity for creativity, and aggression or addiction differently.

Most students express a stereotype of heavy computer gamers as low school achievers. The heavier computer gamer students have more positive attitudes toward the effects of computer games. But, all interviewed children expressed the fascination of computer games.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

This chapter includes the summary, conclusions, implications, and a discussion of the limitations of the study. It also will discuss some possible future research directions based on the findings.

Summary

Regardless of location, and grade, the average time the students spent on play with computer games was around one hour a day in this study. Boys spent significantly more time than girls on computer games and start using computers significantly earlier. As one might expect, students who start to use computers earlier tend to spend more time on computer games. The students who spend more than 3 hours a day on computer games and those who spend less than one hour had higher scores on Figural Originality of the *Torrance Tests of Creative Thinking* (TTCT) than the students who spend 1-3 hours a day. There were no significant differences on the TTCT scales for the 3rd grade students found among different computer groups based on how young they started using the computer. But for the 6th graders, the students who started to use computers late (i.e., at age 10-11) have significantly higher scores on all Verbal TTCT scales and on Figural Elaboration than the students who started computer usage at age 8-9. This is also perplexing. The late group has similar scores with the students who start to use computers under age 5. All students in the earlier group (under age 5) have higher parental SES (M.A. or Ph.D.).

Genres of computer games have significance with regard to Figural Originality. Students who play diverse kinds of computer games have higher scores on Figural Originality than those who play just only one specific game. The students who play only strategy games have lower scores on Figural Originality. Even though the correlation coefficients of different genres on Figural Originality were small, this result shows how different genres of computer games are correlated with Figural Originality (see Figure 9). But it is not manifest to know whether there are differences of effect on creativity by characteristics of computer games or by individual students' different personalities or degrees of motivation. Also, it is hard to know which specific games within genres have effect on children's creativity and whether the effect is the same on each student's creativity. This needs to be researched further.

There is a gender difference on preference of genre of computer games as to time spent on computer games. Additionally, female students tend to prefer less active and less competitive simulation games, while male students prefer active and competitive action or strategy games. This is the same as Kafai's study (1996).

Third grade students have significantly higher scores on all the Verbal TTCT scales than 6th graders. This result is similar to other research, which describes creativity slumps on declines (Smoulcha & Smoulcha, 1985; Torrance, 1965). There was no significant grade difference found on the Figural TTCT scales. Why is there a significant Verbal creativity decline among 6th graders? Six grade students spend more time on structured activities. Structured activities are positively correlated with Figural TTCT scales so that structured activities may mediate to prevent the decline of Figural TTCT. Developmentally, 4th and 5th graders show creativity test decline. Other comparative

research shows the similar creativity decline (Dudek, Strobel, & Runco, 1993; Runco, 2004). Is this a developmental decline in a certain period which can be found regardless of ethnic, social, racial or cultural differences? Another possible conjecture is that structured activities may suppress Verbal TTCT scales, if structured activities are running without verbal discussion or verbal challenge to solve problems, because the 6th grade students spend more time on structured activities than the 3rd grade students.

Even though the tuition rates, the qualities or the patterns of structured activities are different, urban and rural students spend similar time on structured activities. This researcher expected that rural students would spend less time on computer games, structured activities, and TV, but more time on free play. However this expectation was not found in this study. Without distinguishing parental SES or location, the students in this study spend at least one hour a day on structured activities. This shows how Korean students try to spend more time on structured activities competitively nowadays. English is the most common activity and more than half of the students are taking that in various ways; taking an English conversation class, weekly visiting tutoring; group tutoring with native speakers, etc. And in Korea, the higher grade elementary students spend more time on after school activities.

Figure 13 shows how Figural Originality scores of the TTCT, time of structured activities and their parental SES were different by their different computer game groups. The low computer game group tends to spend more time on structured activities, and the heavy computer game group spends less time on structured activities. The moderate computer game group spends the least time on structured activities. There was no significant difference found between these low and heavy computer game groups' scores

of Figural Originality but significance found between the moderate and the heavy computer game groups. It was difficult to explain the characteristics of this moderate computer group or why this difference was found between the heavy and the moderate computer game groups. Less structured activities, parents' attitude toward creativity, children's psychological components (i.e., personality, motivation, and emotional well-being) or other factors may be involved to affect the difference.

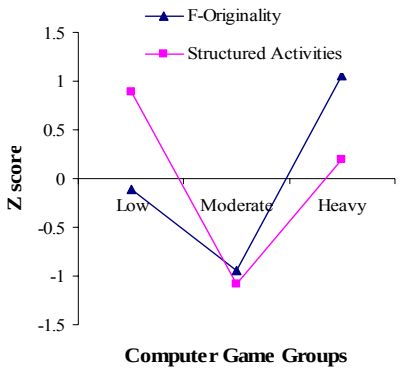

Figure 13. Line plot of Figural Originality score of the TTCT by time spent on structured activities with computer game groups.

The Figural TTCT scales were significant by parental SES and structured activities, but not on the Verbal TTCT scales. The students who spent time more on structured activities have higher scores on the Figural TTCT. On the Verbal TTCT scales, there was no difference found between the heavy structured activity group and the low one. Structured activities seem to suppress verbal creativity because of passive learning patterns, without much verbal discussion or presentation by students. When students are involved in heavy structured activities, their Figural scores seem to be

higher regardless of whether or not they are engaged in heavy computer gamers. Another possible conjecture can be followed from Vygotsky's assumption that children's creative work is more figural and less literal and the literal part will develop late in life (Ayman-Nolley, 1992). When students spend less time on structured activities, they are spending more time on computer games, and are getting higher Figural TTCT scores. Computer games may provide students, who don't or can't have structured activities, challenge to increase Figural creativity in certain ways. Two path models show 'play' factor (computer games, TV, and free play time) is more correlated with Verbal Creativity than Figural Creativity (see Figure 11 & 12).

Most of the students in this study answered that they have little free play time. Some students use words such as "never" or "just a few" to express their dissatisfaction about the lack of their free time to play with friends or do things by themselves without any restriction. There is no difference among heavy, moderate and low free play groups on the TTCT. But the students in this study, who have more time for free play, also tend to have more time for TV and computer games. Computer games instead of free play time may give students freedom to imagine without restriction from parents or structured activities (Gelfond & Salonius-Pasternak, 2005). The parents of the students, who have more free time, tend to be lower in the SES range. Because parents of lower SES can't support their children's structured activities, their children tend to spend more time on free play, computer games and TV. This finding is the same as in Posener and Vandell's (1999) study. Children with parents who work full-time outside the home or with a single parent spend more time with TV, computer, and video games than children with

one adult caretaker (parent, relatives, or paid worker) in the home (Singer & Singer, 2005).

There is a significant difference on parental SES found between urban and rural students. About 90% of the urban school parents in this study have more than a B.A. About 50% of the rural parents have high school diplomas. Students with higher parental SES have higher scores on the Figural TTCT. There is a big difference between students with high school diplomas and students with M.A. and Ph.D. degrees. Because there is a big parental difference between locations on the Figural TTCT, the urban students have higher scores on F-Originality and F-Elaboration than the rural students. It can't be said that parental SES is the only factor to determine children's creativity, but it is hard to deny parental SES is intermingled with the development of children's creativity.

Rural students spend more time on TV than urban students. But the correlation between TV and the Figural TTCT was different by parental SES. The students with Ph.D. parental SES are obtaining lower scores on F-TTCT , spending more time on TV, but the students with high school diploma parental SES are getting higher scores on those scales.

Parents report that they are concerned about the negative effect of computer games on their children's development, but interviewed children said that TV is more harmful than computer games because TV doesn't provide an interactive context as computer games. There seems to be different attitudes toward computer games between parents and children. Interviewed children responded that computer games provide virtual context to meet and make friends. They responded that they can distinguish virtual violence from real violence, but they reported that they showed temporarily low

endurance or short temper right after finishing computer games, which was the same as Anderson's (2002) study. Computer games also provide children a solution for social or emotional problems such as bullies, or parental divorces, and help them to be a member of a virtual community. Stereotype of heavy computer gamers as low achievers was not found in this study.

Conclusions

Computer games may be correlated positively with children's creativity, especially Figural Originality of the TTCT scales. Structured activities are positively correlated with children's figural creativity. Even though free play time may not be correlated strongly with figural creativity, it may be correlated more strongly to verbal creativity of the TTCT scales than any other time spending. TV is negatively correlated with children's creativity (Singer & Singer, 2005), but it is differently correlated with the Figural TTCT by parental SES. The stereotype of heavy computer gamers being associated with low achievers was not found in this study. Students with higher parental SES spend more time on structured activities. This parental factor (parental SES and structured activities) is significantly correlated with the Figural TTCT scales. This shows figural creativity can be developed or improved by some input from the environment, i.e., by activities and experiences that are afforded within different ecological contexts (Bronfenbrenner, 1989). This study also shows how parental SES is differently distributed in urban and rural areas in Korea. Gender differences on computer time, free time play, first computer exposure period, and preferences of genres were found. Different use of platforms was found between rural and urban children. But preference of genres and platforms of computer games may be affected by cultural, social and

economic situations. Sixth graders showed significant creativity decline on the Verbal creativity of the TTCT not on the Figural creativity. Significant differences among genres of computer games related with the TTCT scales were also found.

Other Limitations of the Study

This research had other limitations, beyond the ones mentioned in Chapter I. First, this research included only parents' final education level and structured activities as parental SES. Research data regarding parents' attitudes toward computer games and parental relationships with their children were not collected. The relationship between parents and children, and parents' different methods or their philosophy to raise, motivate, and challenge their children may affect the development of children's creativity. Children's living environment (e.g., their neighborhood, living condition, etc.) must be considered. Also interval variables for parental SES are recommended to be used for statistical analysis.

Second, there is a significant location difference on Figural Originality and Elaboration. But comparisons of teachers' different quality and attitude toward creativity, teaching methods or learning environment between locations were not included in this study. A multi-level comparison was needed to understand which factors produce significant differences between locations and which factors lead to the discrepancy between urban and rural location or by socioeconomic status. Also parental SES from two rural classes was not included in this study. More data would have given fully description to this study.

Third, this researcher found that the creativity instrument was too time consuming for young children. Each activity asks students to work for ten minutes, but

the 3rd grade students became bored during the 10 minute session especially in the urban school. Other instruments to measure creativity (e.g., teachers' assessments or creative products by children) can be included for future studies. A short and new creativity assessment instrument, which has not many sub-categories of creativity for the 21st century should be developed.

Implications for Future Research

Study about Genres of Computer Games

How different genres of computer games work for creativity should be researched, because this study shows there is a significant difference among the different genres of computer games on the TTCT. Gender difference was found among the genres of computer games. But this study didn't identify which exact game has different effects on children's creativity and what kind of characteristics of computer games affect creativity. There may be some differences of preference of genres of computer games among countries or cultures. But there is no research about which characteristics of computer games make different preferences among genders or countries or cultures and what kinds of structures or factors of a specific computer game or one genre influence creativity positively or negatively.

Comparative Study of Different Age Groups and Longitudinal Study

Different age groups may have different experiences, and patterns of computer games. The effect of computer games on aggressiveness, addiction to computer games, social or cognitive development, including creativity, may also be different by their longer history of playing computer games. Longitudinal research and research with different populations should be conducted to describe the correlation of computer games

on children's cognitive, emotional and social development and how these developments are similar or different, relative to computer games. Some experimental research reveals different results. To describe the effect of computer games on social, emotional and cognitive developments, long term observation and repetitive tests will be recommended.

Environmental Factors and Developmental Issues

This study shows that parental socioeconomic status influences children's creativity. Further research is needed to study how to reduce the discrepancy by socioeconomic status or what other factors can be input to increase children's creativity, especially social or affective aspects of creativity (e.g., interests, motivation, collaboration, etc.).

This study shows that parental SES and structured activities are correlated with the Figural TTCT, but doesn't find which factor is correlated with the Verbal TTCT. There seems to be a significant decline of creativity between mid and late childhood. Is this decline unique in certain societies or certain domains? Or is it common in children's development? In this study, there was only a decline in verbal creativity, not in figural creativity. Future studies may investigate how children develop their verbal and figural creativity differently.

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APPENDIX A

STUDENT'S SURVEY QUESTIONNAIRE

School: **Grade:** **Student ID:** **Gender: Male / Female**

How old were you when you first used a computer?
___under 5 years old ___ 6-7 years old ___8-9 years old ___ 10-11 years old

What kind of computer program did you first use?
___ Educational software ___ Internet search or emailing ___ Computer games
___ Word process ___ Music /TV/Movie Others: _____

How good are you using a computer (ex: wording, emailing, web etc.)

EMAIL:	**1**	**2**	**3**	**4**	**5**
WORD PROCESS:	**1**	**2**	**3**	**4**	**5**
INTERNET SEARCH;	**1**	**2**	**3**	**4**	**5**
POWER POINT:	**1**	**2**	**3**	**4**	**5**
WEB EDITING:	**1**	**2**	**3**	**4**	**5**
	POOR	**LITTLE**	**OK**	**GOOD**	**GREAT**

What kind of games do you usually play? (Check whatever you play)
___ Computer software Games __ Online Game ___ Game Console (VIDEO GAME)
___ Handheld games ___ Arcade __ Mobile games
___ I play none of them (**Go to SECTION 6**)
.

Why do you play electronic games?
___ Computer game is more fun than playing outside
___ I can meet friends at the computer games.
___ I learn many new things through computer games
___ I don't know what other things to do for my free time with friends
Other reason: _____

How good are you in computer games?

l	**2**	**3**	**4**	**5**
POOR	**LITTLE**	**OK**	**GOOD**	**GREAT**

SECTION 1: Computer Software Games. If you don't play computer games, go to SECTION2.

How much time did you spend playing computer games yesterday? ___ hr(s)_____min(s)

How many days do you play computer games Monday to Friday?
__5days ___4days ___3days ___2days ___1day

How much time did you spend on a computer game last weekend? ___ hr(s) _____min(s)

What's your favorite computer game?

SECTION 2: Online Computer Games. If you don't play computer online games, go to SECTION 3.

How much time did you spend playing online computer games yesterday?
___ hr(s) _____min(s)

How many days do you play online computer games Monday to Friday?
__5days ___4days ___3days ___2days ___1day

How much time did you spend on one online computer game last weekend?
___ hr(s) _____min(s)

What's your favorite online computer game? _____

SECTION 3: Video Games. If you don't play video games, go to SECTION 4.

How long did you play a video game last time? _____ hr(s) _____min(s)

How many days did you play a video game a week except weekend?
___5days ___4days ___3days ___2days ___1day

How much time did you spend on a video game last weekend? ____hr(s)._____min(s)

What's your favorite video game? _____

SECTION 4: Handheld/Mobile Game. If you don't play handheld game, go to SECTION 5.

How long did you play a handheld/mobile game last time? _____ hr(s) _____min(s)

How many days do you usually play a handheld /mobile game from Monday to Friday after school?
___5days ___4days ___3days ___2days ___1day

How much time do you usually spend on a handheld/mobile game during the weekend? _____hr(s)._____min(s)

What's your favorite handheld/Mobile game? _____

SECTION 5: Arcade Games. If you don't play an Arcade game, go to SECTION 6.

How long did you play an Arcade game last time? _____ hr(s) _____ min(s)

How many days do you usually play an Arcade game from Monday to Friday after school?
___7 days ___6 days ___5days ___4days _____3days ____ 2days ___1day

How long do you usually play an Arcade game during weekend?

What's your favorite Arcade game? _____

SECTION 6: Free play.

How much time do you spend on watching TV during week days? ___hr(s) __min(s)

How much time do you spend on watching TV during weekend? _____hr(s) _____min(s)

How much time do you usually spend on playing with others or by yourself indoors or outside a day from Monday to Friday? (No computer games, No TV, No studying) _____hr(s) _____min(s)

How much time do you spend on playing with others or by yourself indoors or outside during weekend? (No computer games, No TV, No studying) _____hr(s) _____min(s)

SECTION 7: After School Activities.

If you have after school educational activities, write down how many classes of those educational activities you have a week and the exact minutes for one class.

	English		Math		Korean		Science		Art	
	Time	How long	Times	How long	Times	How long	Times	How long	Times	How long
Papers										
School										
Tutoring										
Institute										

	Music		Athletics		Chinese		Computer		Others:	
	Times	How long	Times,	How long	Times	How long	Times	How long	Times	How long
Papers										
School										
Tutoring										
Institute										

THANK YOU!

APPENDIX B

INTERVIEW QUESTIONNAIRE

1 **Why do (don't) you want to play computer games?**

2 **If you play computer games, what's your favorite computer game?**
Explain about your favorite computer games.
If you don't play computer games, what do you usually do for your free time?

3 **What are or are not the fascinating factors in computer games?**

4 **What do you think is the benefit through computer games?**

5 **What do you think is the loss through computer games?**

6 **How much do your parents make intervention on your computer games?**

7 **How do you think that parents worry about the children's aggressive trend influenced by computer games?**

8 **Describe heavy computer gamers- what are their most significant characteristics?**

9 **In what ways do you think you are creative?**

10 **How do computer games affect on your creativity, learning and making friends?**

APPENDIX C

PARENT PERMISSION FORM (ENGLISH)

The Relationship between Children's Computer Game Usage and Creativity in Korea

I understand that the purpose of this study is to know what the effect of computer games is on children's creativity. The results of the study could make some proper guideline for the children to do computer games. Data collection for the study will consist of student's survey questionnaire, Activity 5(Unusual Use of Tin Cans) of Verbal Form B and Activity 2(Incomplete Figures) of Figural Forms B of the Torrance Tests of Creative Thinking (TTCT) (1974), and interviews. The TTCT and the survey will be no more than 20 minutes each. The data collection will be held in recess time not in regular class hours. There is no risk associated with this study. Some students will be selected to be interviewed to be asked about their favorite computer games.

The tests result and survey responses will be coded according to the researcher and contain no personally identifiable information other than a distribution number accessible only by the researcher. This study is confidential. The records of this study will be kept private. Research records will be kept stored securely and only the researcher will have access. The information obtained from this study will be used to complete for a dissertation and may be published in journal articles.

An estimated 500 students will be asked to participate in the survey and the TTCT portion of this study. But this study will be held by voluntary participation. You will be afforded the option to accept or decline participation through not putting your child into the data collection process. If your child doesn't want to participate in the TTCT or the survey portion of this study, the child will do the homework or what the teacher will ask to do instead during the data collection process.

My decision whether or not to participate in this study will not affect current or future relations with your children's school. If you have any question about this research, you can contact the researcher Kyung-Sook Lee, kyungsooklee@neo.tamu.edu, (979) 862-9134 or Dr. William Nash, wnash@tamu.edu, (979) 845-1893.

This research study has been reviewed by the Institutional Review Board-Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through the IRB coordinator, Office of Research Compliance at (979) 458-4067 (irb@tamu.edu).

I have read the above information and I understand the explanation provided to me. By signing this document, I voluntarily agree my child to participate in this study. I have been given a copy of this form.

Child's Name_____

Parent's Signature_____ Date_____

Researcher's Signature_____ Date_____

APPENDIX D

PARENT PERMISSION FORM (KOREAN)

컴퓨터 게임의 아동의 창의성에 미치는 영향에 관한 연구에 대한 학부모 동의서

안녕하세요? 저는 미국 텍사스 에이 앤 엠 대학의 교육 심리학과의 박사 과정에 있는 이경숙입니다. 컴퓨터 게임이 아동들의 창의성에 어떤 영향을 미치는 지에 대한 연구를 하려고 학부모님의 자녀를 대상으로 토란스의 창의적 사고 검사지 언어와 도형 B 유형에서 각각 한 문항씩을 20 분 동안 검사하려고 합니다. 컴퓨터 게임에 대한 설문 조사도 하려고 하는 데, 최대 20 분 정도 소요됩니다, 검사 및 설문 조사는 정규 수업시간이 아닌 쉬는 시간에 실시가 되며, 어떤 위험도 이 검사에 수반되지 않습니다.

검사나 설문 조사에 참여한 학생에 대한 구체적인 신상내용(성별, 학교와 반, 성적, 가정 조사 등)은 비밀에 부쳐 지며, 학생 개인의 신상은 공개되지 않습니다. 연구 기록은 비밀에 보관되며, 본 연구자만이 개인적으로 관리하며, 연구자의 논문연구에 사용하며, 연구 지에 연구결과는 출판될 수도 있습니다.

약 500 명 정도의 학생들이 토란스의 창의적 사고 검사와 설문지에 참여할 계획입니다. 그러나 이 검사나 설문 참여는 자발적인 것이기 때문에 학부모님께서 자녀의 참여를 원하지 않으시면, 이 학부모 동의서에 서명을 하지 않거나, 학생이 검사 시 참여하지 않으면 됩니다. 검사 시간 동안 참여하지 않는 학생은 담당 교사가 제시하는 활동을 하게 됩니다.

본 연구에 대한 참여나 불 참여는 학생들의 학업 성적이나 학교 생활에 어떤 영향도 미치지 않습니다. 이 연구에 대해 질문이 있으시면, 저나 담당 지도 교수인 윌리엄 W 내쉬 박사의 이 메일 주소나 전화로 연락하시면 됩니다.
(이경숙: kyungsooklee@neo.tamu.edu, 979-862-9134)
(윌리엄 W 내쉬 박사: wnash@neo.tamu.edu 979-845-1893)

이 연구는 텍사스 에이 앤 엠 대학의 IRB 에 의해 인준을 받았다. 연구와 관련되어 문제나 연구 대상자의 권리에 대해 질문이 있으면, IRB 의 담당자에게 연락하면 됩니다.
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감사합니다.

나는 위의 모든 내용을 읽고 이해 하였고, 이 연구에 대해 이의가 없음으로, 나의 자녀가 이 연구에 참여하는 것을 동의하여 이 동의서에 서명합니다.

학 생　이름:_____

학부모 서명: _____　날짜: _____

연구자 서명: _____　날짜: _____

APPENDIX E

STUDENT ASSENT FORM (ENGLISH)

The Relationship between Children's Computer Game Usage and Creativity in Korea

The purpose of the study:
I understand that Kyung-Sook Lee, a researcher at Texas A&M University, will study the relationship between children's computer game usage and creativity in Korea. I am one of 500 students will be asked to participate in this study by completing a survey.

I understand that:

1. My participation in answering the survey is strictly voluntary. I can refuse to answer any survey questions that make me feel uncomfortable.
2. I am instructed not to put my name or any other identifying marks on the survey.
3. I may withdraw from the study at any time and for any reason with no penalty, if I decide not to participate, it will not hurt my grade or class standing.
4. If I do not participate in this study, I will continue to participate in other classroom activities as assigned by the teacher.

This research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through the IRB coordinator, Office of Research Compliance at (979) 458-4067 (irb@tamu.edu).

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction.

_____ I do voluntarily agree to participate in this study.

_____ I do not agree to participate in this study.

I have been given a copy of this assent form.

Student's full name (printed) _____

Student's Signature _____ Date _____

Researcher's Signature _____ Date _____

If I have any questions or concerns, I may contact the researcher, Kyung-Sook Lee, kyungsooklee@neo.tamu.edu, (979) 862-9134 or Dr. Nash, wnash@tamu.edu, (979) 845-1893 at Texas A&M University, College Station, TX 77843.

APPENDIX F

STUDENT ASSENT FORM (KOREAN): 학생 동의서

컴퓨터 게임이 아동 창의성에 미치는 영향

연구의 목적:
미국 텍사스 에이 앤드 엠 대학의 박사과정에 있는 이경숙 학생이 컴퓨터 게임이 아동 창의성에 미치는 영향에 대한 연구를 들었다. 나는 이 연구에 참여하는 500 여명의 학생의 하나로 참여할 것을 요청받았다,

그래서 다음 사항을 이해한다:

1. 이 연구 참여는 자발적인 것이며, 내가 대답하기 불편한 싫은 설문 내용에 대해서는 거부할 수 있다.
2. 이 연구에 내 이름을 밝히지 않도록 되어 있다.
3. 설문 도중 언제든지 나는 설문에서 빠질 수 있으며, 비 참여에 대한 처벌은 없으며, 나의 학교 성적이나, 수업 참여에 어떠한 영향도 미치지 않는다.
4. 만약 설문에 응하지 않기로 결정하면, 담임 교사가 제시하는 숙제등 다른 활동을 하게 된다.

이 연구는 텍사스 에이 앤 엠 대학의 아이 알 비(IRB)의 검사를 거쳤고, 이 연구에 있어 아동의 권리에 대한 질문이나 문제가 생기면, 아이 알 비 사무실의 책임자에게 연락하면 됩니다.
(979) 458-4067, irb@tamu.edu

나는 위의 사항에 대해 읽고 이해를 한다. 그리고 이 연구과정에 대한 질문을 모두 대답 받았다.

_____ 나는 이 연구에 자발적으로 참여하는 데 동의한다.

_____ 나는 이 연구에 참여하지 않는 데 동의한다.

나는 이 동의서에 서명한다.

학생의 이름 _____

학생의 서명 _____ 날짜_____

연구자 서명 _____ 날짜_____

만약 이 연구에 대한 질문이나 문제가 있으면, 연구자인 이경숙 (979) 862-9134, kyungsooklee@neo.tamu.edu) 이나 텍사스 에이 앤 엠 대학의 내쉬 박사 (979) 845-1893, wnash@tamu.edu)로 연락하면 됩니다.

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